

# Endangered Species UPDATE

*Including a Reprint of the latest USFWS  
Endangered Species Technical Bulletin*

May 1993 Vol. 10 No. 7

School of Natural Resources and Environment  
THE UNIVERSITY OF MICHIGAN



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# The Role of the National Wildlife Refuge System in Endangered Species Management

by

Mary Anne Young

The National Wildlife Refuge System (Refuge System), the land base for the Fish and Wildlife Service (USFWS), plays a key role in endangered species conservation. Seventy years before the 1973 Endangered Species Act (ESA) was passed, the USFWS was ahead of the game, with the establishment of the first refuge by President Theodore Roosevelt. Pelican Island National Wildlife Refuge in Florida, was the forerunner of an awesome system of lands that continues to expand and to face a multitude of challenges and opportunities. As we approach the 100th anniversary of the National Wildlife Refuge System, we are reflecting on our history and examining our potential for management of endangered species.

Globally, there are 1,178 species on the endangered species list. Four thousand species are candidate species or species that might become endangered or threatened if current trends continue. Of these astounding world-wide totals, 750 of the endangered and threatened species and 3,000 of the candidate species are found in the United States or its territories. Approximately 24% of the species currently listed in the United States are found on refuges.

Approximately 178 endangered and threatened ("listed") species and 360 candidate species occur within the Refuge System. For listed species the breakdown is 33 mammals, 47 birds, 18 reptiles, 2 amphibians, 24 fish, 6 insects, 5 clams, 1 crayfish, 1 snail, and 41 plants.

The percentage of listed species on refuges

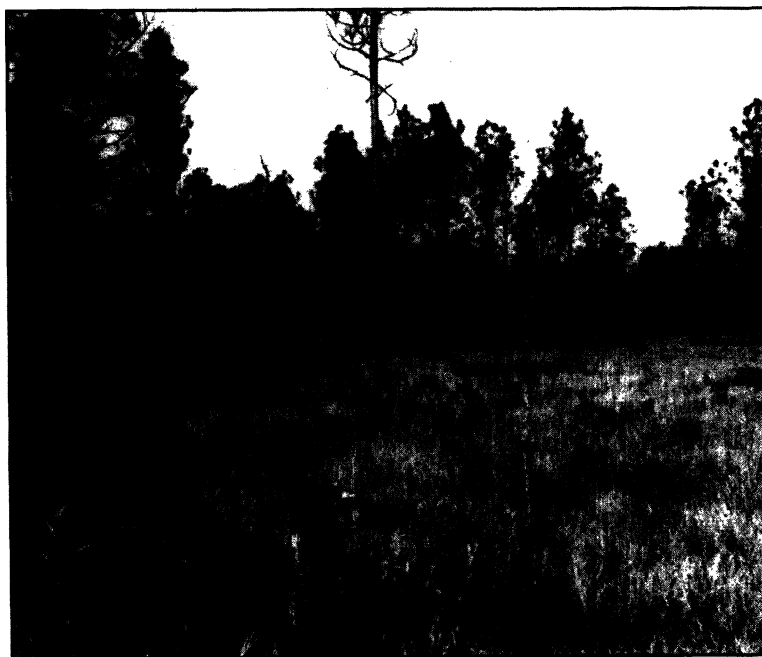
may appear small compared to the national total. The significance of the refuge's role does not lie in numbers, however, but in potential. Refuges are legally and administratively required to conserve endangered species. Of prime importance is the fact that what happens on refuge lands can be controlled. When listed species are documented on refuges, quick and effective conservation measures can be implemented.

An enormous variety of habitats are represented within the 91 million acres of refuge land that stretches across the Nation. Within the 487 refuge units, most major ecosystems within North America and the Caribbean—from Alaska to Puerto Rico, the Virgin Islands and Samoa—are represented. Thirty-one million acres of refuge land alone are vital wetlands. Vast freshwater marshes, swamps, bogs, lakes, ponds, streams, rivers, coastal and estuarine systems are woven through the Refuge System. Terrestrial habitat includes prairie

grasslands, desert sands, rock, arctic perennial snow and ice, and the many forest types encompassing 16 million acres. Forests include the cool northern coniferous forests, the deciduous eastern hardwoods, rich bottomland hardwood forests, subtropical broadleaf evergreen, and Southern longleaf pine.

Although the Refuge System has been associated with management of waterfowl, it should now be obvious that these rich lands offer much more! In addition to habitat for game species, (one end of the management continuum), refuges provide vital migratory, breeding, and wintering areas for many nongame species. Millions of shorebirds use refuge land along with wading birds, Neotropical migrants and raptors. Plants, fish, small mammals and a variety of reptiles and amphibians are nongame resources found on refuges. Many of the latter are candidate species whose protection on refuges may deter their listing as endangered or threatened species at a future date. Add endangered species management to this, and a more balanced picture of refuges evolves.

We realize that many species will continue to decline if current pressures continue. At no time has the pressure on refuges been greater than here at the end of the 20th century. Rapid urbanization, the constant threat of contamination of air and water supplies and the demand for outdoor recreation are some of the potpourri of pressures exerted on the Refuge System. (Some of these dilemmas are addressed in the recently published



The National Wildlife Refuge System protects many wetlands, such as this emergent wetland. Systems like these are vital for the survival of a vast number of species. Photo by Virginia Carter, U.S. Geological Survey.

Draft Plan and Draft Environmental Impact Statement, *Refuges 2003: A Plan for the Future of the National Wildlife Refuge System.*)

Many factors contribute to a species' decline and many of the dramas have been played out on refuge lands. For example, some fish, wildlife or plants, occupy specialized niches, like the desert pupfish; others have been directly exploited for commercial profit, like the indigo snake. Some species, like the endangered mussels, suffer from depletion of their host fish species. The struggle against polluted environments is well documented for species like the brown pelican, the peregrine falcon and the bald eagle. The invasion of exotic or feral species is causing declines in species like the endangered forest birds in Hawaii. Some species have been jeopardized by others whose range has expanded from man's alteration of the landscape. Infamous examples of range expansion include the brown-headed cowbird, a brood parasite of the endangered Kirtland's warbler, and the eastward movement of the coyote, that through interbreeding, contributed to the red wolf's extinction in the wild.

National Wildlife Refuges (NWRs) are legally required to manage and conserve endangered species. One of the primary goals of the National Wildlife Refuge System is "to preserve, restore and enhance in their natural ecosystems (when practicable) all species of animals and plants that are endangered or threatened with becoming endangered" (USFWS Refuge Manual 2RM1.4, March 1982). What is being done specifically for the recovery of endangered species on refuges?

### Refuge Acquisitions for Endangered Species

Land acquisition specifically for endangered species has become an extremely valuable part of endangered species conservation. The ESA authorizes land to be purchased for endangered species conservation. Since only a small fraction of listed or candidate species occur on public land, the more habitat in protected ownership, the better the chance for recovery. Fifty-eight refuges

have been acquired for endangered species. These include National Key Deer NWR, Florida; Crystal River NWR, Florida (manatee); Attwater Prairie Chicken NWR, Texas; Mississippi Sandhill Crane NWR, Mississippi; Kirtland's Warbler NWR, Michigan; Tijuana Slough NWR, California (light-footed clapper rail); Buenos Aires NWR, Arizona (masked bobwhite quail); and Archie Carr NWR, Florida (green and loggerhead sea turtles).

Many refuge acquisitions protect several listed species. For example, in 1988 Congress appropriated money for initial funding of the Sacramento River NWR, California which provides habitat for several listed species including the valley elderberry longhorn beetle, the bald eagle and the least Bell's vireo. In 1993, funding was approved for Balcones Canyonlands NWR, Texas, for conservation of the black-capped vireo and the golden-cheeked warbler. Wetland acquisitions are also important to listed species. The acquisition of Pinhook Swamp NWR, Florida provides an important habitat corridor between Oseola National Forest and Okefenokee Refuge, potentially benefiting several species including the red-cockaded woodpecker. A new land acquisition category for biological diversity was added in 1992. This focuses on communities adding yet another aspect of protection for biological resources.

The extent of refuge activities with endangered species was evaluated during 1990 survey of refuges compiled for *Refuges 2003*. The survey found that of the 400 refuges which had documented the occurrence of a listed species, 356 refuges had developed some inventory, monitoring or active management strategies. Conservation measures varied widely, depending on the refuge and the number of endangered species present. Some refuges like Merritt Island NWR, Florida, must manage for at least 15 listed species. These include bald eagle, green and loggerhead sea turtles, manatee, wood stork, Atlantic salt marsh snake, roseate tern and 9 candidate plants, including fragrant prickly apple cactus. All this must be done with the backdrop of two active launchpads from the NASA space program. On the other hand, ref-

## Endangered Species UPDATE

A forum for information exchange on endangered species issues  
May 1993 Vol. 10 No. 7

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

Readers include a broad range of professionals in both scientific and policy fields. Articles should be written in an easily understandable style for a knowledgeable audience. For further information, contact the editor.

### Subscription Information:

The *Endangered Species UPDATE* is published approximately ten times per year by the School of Natural Resources and Environment at The University of Michigan. Annual rates are \$23 for regular subscriptions, and \$18 for students and senior citizens (add \$5 for postage outside the US). Students please enclose advisor's signature on university letterhead. Send check or money order (payable to The University of Michigan) to:

*Endangered Species UPDATE*  
School of Natural Resources  
and Environment  
The University of Michigan  
Ann Arbor, MI 48109-1115  
(313) 763-3243

Cover: Florida panther (*Felis concolor*).  
Photo by U.S. Fish and Wildlife Service.

The views expressed in the *Endangered Species UPDATE* are those of the author and may not necessarily reflect those of the US Fish and Wildlife Service or The University of Michigan.

Production of this issue was made possible by major support from the National Fish and Wildlife Foundation, with additional support from the Chevron Corporation and the International Association of Fish and Wildlife Agencies.



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uges like Mississippi Sandhill Crane NWR manage in a bit more simplistic arena, since this refuge was acquired specifically for the sandhill crane.

### A Variety of Refuge Activities

Programs to protect bald eagle nesting trees are common. Over 300 refuges protect raptors like the bald eagle, and the peregrine falcon. Control of invasive species, such as removal of Australian pine on sea turtle beaches in Florida, is crucial to maintaining habitat integrity. Prescribed fire is a useful and frequently employed tool for maintaining the habitat of species like the red-cockaded woodpecker, Attwater's prairie chicken and Kirtland's warbler.

Restriction of human access can be crucial to many species. Both foot and vehicular traffic have contributed to the decline of many species. Limiting public use on piping plover beaches is proving effective in the recovery of this shorebird. Control of vehicular traffic for protecting species whose habitat runs in proximity to major thoroughfares is extremely important. For example, the diminutive Key deer, the American crocodile and the Florida panther have all suffered high mortalities due to car fatalities along Route 1 in south Florida.

Refuges manipulate water regimes to meet the needs of species like the Florida snail kite or the western prairie fringed orchid. Managing predation, including the impact of raccoons on sea turtles' beaches, can be an important activity on refuges. Restoration of native pine habitat is important for gopher tortoises and indigo snakes in the South, and restoration of oak savannah on Necedah NWR, Wisconsin will contribute to the survival of the Karner blue butterfly. Cave-dependent species like Indiana and gray bats or the Ozark cave fish profit from refuge management of their unique cave ecosystems. Management for these creatures must include limiting access often by cave-gating as well as maintaining the purity of the surrounding watersheds.

Many refuges conduct inventories for species that could potentially occur on their land. Flint Hills NWR in Kansas, for example, conducted routine sur-

veys in 1992 to determine if the endangered American burying beetle was on the refuge. Extensive surveys on and off the refuge located a species of burying beetle but not the endangered one; it is significant however, that the initiative was taken to locate this obscure species. Invertebrate surveys will increase on refuges as more knowledge about the particular species becomes available.

Due to the overwhelming load on the endangered species program, final recovery plans are not yet in place for the numerous listed species on refuges.



Students participated in surveys, at Flint Hills NWR—Kansas, to determine the occurrence of the American burying beetle. Photo by Bill Welton.

Therefore, refuge personnel must use the best information available and extensively coordinate within the USFWS and with states and other federal agencies to implement the best management.

Coordination is especially sensitive in the case of areas designated as critical habitat. Critical habitat designation implies that the area contains those elements needed for a listed species' survival. Fifty-one refuges, encompassing a total of 462,309 acres, are in critical habitat. These areas include: Crystal River NWR, Florida (Florida manatee); Ash Meadows NWR, Nevada (12 species of plants and fish); Hawaiian Islands NWR, Hawaii (monk seal); Matagorda Island NWR, Texas (whoop-

ing crane); and San Bernardino NWR, Arizona (Yaqui chub).

From the legal and administrative standpoint, Refuge System goals emphasize the protection of endangered species and their habitat. In addition to the restrictions under critical habitat, other sections of the ESA, (Section 6 and Section 7), are applicable to refuges as well. Section 7 requires consultation if a federal action might affect a listed species or its habitat. Few conflicts have existed between refuge activities and endangered species conservation.

Should a possible conflict arise, an intra-agency consultation would begin between the refuge and the Ecological Services Field Office (the office with regulatory responsibility for ESA within the USFWS). Refuges' activities like diking, prescribed burning, or providing marsh openings would be subject to consultations if the activities might impact a listed species.

### The Panther Project

Section 6 of the ESA encourages cooperation with state wildlife agencies. Qualifying states, i.e., those with Cooperative Agreements, may request matching funds from the USFWS for

endangered species activities. From a refuge perspective, this often provides interesting opportunities for refuges to work directly with state programs. The Florida panther project is an example of this type of cooperative effort with the State of Florida.

Grant-in-aid monies have contributed to the Florida panther recovery program in the Florida Game and Freshwater Fish Commission for several years. Because the panther crosses so many jurisdictions, an interagency committee was formed to maintain a dialogue between diverse groups. In addition, the USFWS has employed a full-time Florida Panther coordinator.

Of great significance, however, was the acquisition of the Florida Panther NWR in 1989. The refuge was established to enhance protection of a key portion of the panther's known current range and habitat which is under threat from the constant development in the State of Florida. Radio telemetry studies conducted by the state since 1981 showed that the 25,000 acres acquired for the refuge has the greatest density of panther activity of any area within the currently occupied range. It was this state-collected information that most strongly justified USFWS acquisition of the area for \$10.2 million.

Now under refuge management, panthers and their habitat are being both protected and managed. Management programs include prescribed burning, food plot establishment (for deer), exotic plant control, and hydrological restoration. Refuge biologists monitor management impacts on plant communities and panther prey species such as deer and hogs. However, it is the state's panther radio telemetry data that will ultimately provide the information needed to evaluate the impact of refuge management programs on the panther population. Well-documented successful habitat management programs will have broad application throughout the panther's 3.1 million acre range.

### Utilizing GIS

Innovative technologies are also being employed on refuge land. The 77 million acres of land managed by the

USFWS in Alaska are part of a new Geographic Information System (GIS). This will assess available and potential listed species' habitats and eventually lead to more efficient coordination of fishermen, hunters, subsistence users, and their relation to endangered species. Minnesota Valley NWR has used GIS to relocate hiking trails away from the zone of influence around eagle nests and into habitat more suitable for trail development. They are also inventorying and monitoring the health of sensitive habitats. The USFWS's Branch of Fire Management is using mapping software to spatially manage national fire business information including the effects of fire and fire suppression on endangered species management.

### Recovery Programs

Seventeen refuges have reintroduced listed species. In the southeast, the red wolf is back in the wild after being declared extinct in its historic range. An innovative experimental release program on Cape Romain NWR, South Carolina in the early 1970s spawned the current red wolf recovery effort. Today red wolves roam wild on several refuges including Alligator River NWR, North Carolina. In the west, introduction of an experimental population of black-footed ferrets is proposed for a section of the Charles M. Russell NWR, Montana.

### Educating the Public

Environmental education programs on refuges enhance appreciation of refuge wildlife, particularly endangered species. Environmental education integrates environmental concepts into formal educational activities. Outdoor classrooms and indoor laboratories are particularly useful in urban settings. Refuges like Great Swamp NWR, New Jersey, and San Francisco Bay NWR, California have strong urban programs. The value of public outreach to conservation in general cannot be overstated. Nor can the statistics which show that nonconsumptive use of public lands is growing rapidly.

Viewing wildlife is significant to

any outdoor experience. In 1991, the Refuge System joined with 13 other agencies and organizations to promote the Watchable Wildlife Program. Watchable Wildlife includes enjoyment of viewing game, nongame and endangered species. Some endangered species like the manatee, key deer, bald eagle, red-cockaded woodpecker, wood stork and piping plover can be readily visible to the public. The thrill of seeing endangered species in their natural habitat goes a long way to foster public interest.

As 2003, the 100th anniversary of the Refuge System, draws near, we feel that President Roosevelt would be proud of his initiative! The size of the Refuge System is appreciable, but equally impressive is the continually evolving character of refuges. Due to the increased dimension, opportunities for saving endangered species will flourish. No longer viewed as self-contained units, refuges continue to redefine their capabilities to meet current and future demands. Refuges are examining the preservation of biological diversity, the management of ecosystems and their own connection to the world outside refuge boundaries. This trend will continue into the 21st century and with acquisition of each new refuge. With this broader focus, endangered species and all other species in the trust of National Wildlife Refuge System will have safe and prosperous havens.

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# A Survey on Endangered Species in National Wildlife Refuges

by

Rebecca A. Schneider

Wildlife refuges are important areas for species conservation as habitat fragmentation and destruction are increasingly problems for species' survival. Refuges are managed by the U.S. Fish and Wildlife Service (USFWS) for the protection and preservation of wildlife habitats. There are currently 487 units of the National Wildlife Refuge System located across the United States totaling approximately 90 million acres of land and water. To date, there has been little information available on the types of endangered and threatened species that benefit from the refuge system. I conducted a survey of wildlife refuges across the nation to determine the role that wildlife refuges play in the conservation of threatened and endangered species.

## Methods

Ten percent of the refuge managers in each of the seven regions were randomly selected for the survey, using the USFWS's "1992 Refuge Manager's Address List" of 280 managers. The survey was conducted by mail requesting information on: the size of the refuge; federally listed threatened and endangered species serviced by the refuge; habitats located in the refuge; the most important habitat for the threatened and endangered species; and challenges and/or problems faced by the refuge managers (see Figure 1).

A total of 31 surveys were mailed to refuge managers; 29 mail responses were received. The two non-respondents were surveyed by telephone. In a few cases managers responsible for more than one refuge unit made separate responses for those units. Thus, 35 survey responses are tabulated here. The survey results (Table 1) include the refuge name, state, USFWS region, refuge size (acres), habitats, key habitat, challenges

facing managers, federally listed species served by the refuge, and species taxon.

## Species

A total of 42 federally listed species were indicated on the surveys: 7 mammals, 12 birds, 9 reptiles, 8 fish, 2 invertebrates, and 4 plants. While the number of species served by the National Wildlife Refuge System reportedly is higher [see article by Young, this *UPDATE* issue], this may be due to a certain number of refuges containing several species not found in other refuges. For the 35 refuges in this survey, the number of species per refuge ranged from 0 to 8, with an average of about 3 species per refuge. Considering the large number of threatened and endangered species listed in the United States, I found this to be a surprisingly low number of species served.

The refuges are primarily servicing bird species, such as bald eagles, who use the refuges as stops during their migration. Bald eagles occurred 24 times and peregrine falcons occurred 23 times; piping plovers, interior least terns, and whooping cranes each occurred 5 times. Turtles constituted the majority of the reptiles represented in this survey.

## Habitats

Habitats listed as important for threatened and endangered species were primarily wetland habitats, such as freshwater marshes, and swamps, along with rivers and lakes. These are used by terns, eagles, and other bird species for nesting and hunting grounds. Eagles feed on waterfowl as well as mammals found in open areas such as croplands.

In Table 1, "Habitats" are listed in order of the types occupying the 1st, 2nd, and 3rd most area of the refuge.

"Key Habitat" indicates the habitat respondents felt was most important for threatened and endangered species in their refuge. In some cases this habitat was not among the top three in area for the refuge.

## Challenges

The challenges that refuge managers face in protecting threatened and endangered species are diverse and plentiful. Table 1 lists the challenges in order of importance as indicated by the respondent. Some of the more common problems are related to human impacts like agriculture, urban development, water contamination, and invasion of exotic species. With agriculture, comes the run-off of pesticides into the watershed; urban development causes increased run-off into local watersheds resulting in soil erosion, water contamination, and flooding. Not only is habitat lost, but surrounding habitats are altered. Another common problem is the invasion of undesirable species. New species are often introduced in an area by humans and result in out-competing native species or desirable species.

Human activity is rooted in most conservation problems and has tremendous impacts on wildlife species. Agricultural and urban development continue to consume important wildlife habitats. We need to begin to curtail our impact on the environment for the safety of all species.

I would like to thank the refuge managers who participated in this survey and the managers consulted for the preliminary write-up of the survey. Your cooperation and timely response was greatly appreciated.

Rebecca A. Schneider is a senior Resource Ecology Management student in the School of Natural Resources at the University of Michigan. Her area of focus is wildlife management and conservation.



## Table 1. National Wildlife

Refuge	State	Region	Acres	Habitats
Bon Secour	Alabama	4	4,500	Maritime forest Beach Saltwater marsh
Eufaula	Alabama	4	11,400	Lake Flooded bottomlands Mixed forest
Alaska Maritime	Alaska	7	4.9 million	Tundra Marine islets Beach
Yukon Flats	Alaska	7	10.5 million	Freshwater marsh Bog or fen River
Holla Bend	Arkansas	4	6,486	Cropland Flooded bottomlands Deciduous forest
Logan Cave*	Arkansas	4	120	Troglobitic Deciduous forest
Alamosa/Monte Vista	Colorado	6	25,358	Freshwater marsh Flooded bottomlands Wet meadows
Browns Park	Colorado	6	13,455	Freshwater marsh River Grassland
Florida Panther	Florida	4	24,300	Swamp Coniferous forest Deciduous forest
Camas	Idaho	1	10,578	Freshwater marsh Grassland
Desoto	Iowa	3	7,823	Cropland Grassland Open woodland

\* Refuge units for which the manager made a separate survey response.  
The habitats are listed in order of greatest to least acreage occupying the refuge.



# Refuge Survey Responses

Key Habitat	Challenges	Species	Taxon
Beach	Urban development	Bald Eagle	B
		Peregrine Falcon	B
	Human disturbance	Piping Plover	B
		Alabama Beach Mouse	M
		Loggerhead Sea Turtle	R
Mudflats	Water manipulation projects	Bald Eagle	B
		Peregrine Falcon	B
	Invasion of undesirable species	Wood Stork	B
Tundra	Invasion of undesirable species	Aleutian Canada Goose	B
		Arctic Peregrine Falcon	B
	Commercial fishing	Steller Sea-Lion	M
		Aleutian Shield-Fern	P
River	Oil and gas development	Peregrine Falcon	B
	Human disturbance		
Cropland	Flooding	Bald Eagle	B
	Waste disposal by poultry farms	American Alligator	R
Troglobitic	Human disturbance	Ozark Cavefish	F
	Water contamination	Gray Bat	M
		Indiana Bat	M
Wet Meadows	Invasion of undesirable species	Bald Eagle	B
		Peregrine Falcon	B
	Funding	Whooping Crane	B
River	Restricted releases of water	Bald Eagle	B
		Peregrine Falcon	B
	Invasion of undesirable species	Bonytail Chub	F
		Colorado Squawfish	F
		Humpback Chub	F
		Razorback Sucker	F
Coniferous forest	Urban development	Bald Eagle	B
	Expansion of agriculture	Florida Grasshopper Sparrow	B
		Wood Stork	B
		Florida Panther	M
		American Alligator	R
		Eastern Indigo Snake	R
N/A	Drought and falling water table	Bald Eagle	B
	Expansion of agriculture	Peregrine Falcon	B
Wetlands	Disease	Bald Eagle	B
	Water contamination	Interior Least Tern	B
		Osprey	B
		Piping Plover	B

Challenges are listed in order of importance as indicated by the respondent.

Taxon Key: B = Bird; F = Fish; I = Invertebrate; M = Mammal; P = Plant; R = Reptile

## Table 1. National Wildlife

Refuge	State	Region	Acres	Habitats
Flint Hills	Kansas	6	16,464	Flooded bottomlands Freshwater marsh Open woodlands
Sunkhaze Meadows	Maine	5	9,337	Mixed forest Bog or fen River
Patuxent Wildlife Research Cntr.	Maryland	5	12,700	Mixed forest Flooded bottomlands Meadows
Big Stone	Minnesota	3	14,000	Grassland Flooded bottomlands River
Yazoo	Mississippi	4	70,000	Bottomland hardwoods Swamp Cropland
Mingo	Missouri	3	21,676	Deciduous forest Flooded bottomlands Swamp
Ozark Cavefish *	Missouri	3	40	Deciduous forest Grassland Cave
Pilat Knob*	Missouri	3	90	Deciduous forest Cave
Red Rock Lakes	Montana	6	44,157	Grassland Lake Freshwater marsh
Desert National Wildlife Range	Nevada	1	1.5 million	Desert Open woodland Mixed forest
Long Island	New York	5	6,000	Saltwater marsh Deciduous forest Freshwater marsh
Tewaukon Complex	North Dakota	6	8,700	Freshwater marsh Grassland Lake
Salt Plains	Oklahoma	2	32,030	Salt flats Lake Grassland
Sequoyah	Oklahoma	2	20,800	Lake Cropland Deciduous forest

\* Refuge units for which the manager made a separate survey response.

The habitats are listed in order of greatest to least acreage occupying the refuge.

# Refuge Survey Responses

Key Habitat	Challenges	Species	Taxon
River	Siltation	Bald Eagle	B
	Invasion of undesirable species	Peregrine Falcon	B
		Neosho Madtom	F
Bog	Urban development	Bald Eagle	B
	Human disturbance	Peregrine Falcon	B
Freshwater marsh	Siltation	Bald Eagle	B
	Urban development	Peregrine Falcon	B
Wetlands	Siltation	Bald Eagle	B
	Soil erosion		
Swamps	Siltation	Bald Eagle	B
	Pesticide use/water contamination	Interior Least Tern	B
		Peregrine Falcon	B
		American Alligator	R
Swamp	Invasion of undesirable species	Bald Eagle	B
	Human disturbance	Peregrine Falcon	B
Cave	Human disturbance	Ozark Cavefish	F
	Urban development		
Cave	Human disturbance	Indiana Bat	M
Different for each species	Siltation	Bald Eagle	B
	Livestock grazing	Peregrine Falcon	B
		Whooping Crane	B
Desert	Military use	Pahrump Poolfish	F
	Human disturbance	Hidden Forest Chipmunk	M
		Desert Tortoise	R
		Chuckwalla	R
Marine beach	Urban development	Bald Eagle	B
		Peregrine Falcon	B
	Human disturbance	Piping Plover	B
		Roseate Tern	B
		Sandplain Gerardia	P
		Loggerhead Sea Turtle	R
		Atlantic Ridley Sea Turtle	R
Freshwater marsh	Wetland drainage	Bald Eagle	B
	Water contamination	Peregrine Falcon	B
Marsh/Saltflats	Siltation	Bald Eagle	B
	Human disturbance	Interior Least Tern	B
		Peregrine Falcon	B
		Whooping Crane	B
Lake/Mudflats	Human disturbance	Bald Eagle	B
		Interior Least Tern	B
	Pesticide use	Peregrine Falcon	B
		American Burying Beetle	I

Challenges are listed in order of importance as indicated by the respondent.

Taxon Key: B = Bird; F = Fish; I = Invertebrate; M = Mammal; P = Plant; R = Reptile

## Table 1. National Wildlife

<b>Refuge</b>	<b>State</b>	<b>Region</b>	<b>Acres</b>	<b>Habitats</b>
Oklahoma Bat Caves*	Oklahoma	2	800	Deciduous forest Open woodlands Cave
Washita	Oklahoma	2	8,200	Lake Grassland Farmland
Sheldon/Hart Mountain Complex	Oregon	1	821,756	Desert
Cabo Rojo	Puerto Rico	4	587	Sub-tropical dry forests Exotic grasslands Scrub
Hatchie	Tennessee	4	11,556	Flooded bottomlands Swamp Cropland
Aransas	Texas	2	58,502	Grassland/Brushland Brackish marsh Freshwater marsh
Matagorda Island*	Texas	2	56,668	Grassland Brackish marsh Beach
Mason Neck	Virginia	5	2,277	Deciduous forest Freshwater marsh River
Turnbull	Washington	1	15,468	Coniferous forest Freshwater marsh Grassland
Ohio River Islands	West Virginia	5	350	Flooded bottomlands River Bottomland hardwoods

\* Refuge units for which the manager made a separate survey response.

The habitats are listed in order of greatest to least acreage occupying the refuge.

# Refuge Survey Responses

Key Habitat	Challenges	Species	Taxon
Cave	Human disturbance	Gray Bat	M
	Pesticide use	Ozark Big-eared Bat	M
Lake	Soil erosion	Bald Eagle	B
	Water contamination	Interior Least Tern	B
		Whooping Crane	B
Desert	Livestock grazing	None	
	Mining		
Sub-tropical dry forests	Invasion of undesirable species	Peregrine Falcon	B
	Urban development	Yellow-shouldered Blackbird	B
		Cobana Negra	P
		<i>Arstida chaseae</i>	P
Open waters	Siltation	Bald Eagle	B
	Flooding		
N/A	Human disturbance	Brown Pelican	B
	Soil erosion	Peregrine Falcon	B
		Piping Plover	B
		Whooping Crane	B
N/A	Human disturbance	Brown Pelican	B
	Invasion of undesirable species	Peregrine Falcon	B
		Piping Plover	B
		Whooping Crane	B
		Atlantic Ridley Sea Turtle	R
		Atlantic Green Sea Turtle	R
		Leatherback Sea Turtle	R
	Loggerhead Sea Turtle	R	
Deciduous forest/River	Human disturbance	Bald Eagle	B
	Soil erosion	Peregrine Falcon	B
Freshwater marsh	Urban development	Bald Eagle	B
	Invasion of undesirable species	Peregrine Falcon	B
Bottomland hardwoods/ River	Urban development	Bald Eagle	B
	Siltation	Peregrine Falcon	B
		Pink Mucket Pearly Mussel	I
		Indiana Bat	M

Challenges are listed in order of importance as indicated by the respondent.

Taxon Key: B = Bird; F = Fish; I = Invertebrate; M = Mammal; P = Plant; R = Reptile

# Minnesota's Nongame Wildlife Program

by

Carrol L. Henderson

Minnesota's Nongame Wildlife Program (NWP) has grown and diversified considerably since it was created in the Department of Natural Resources' Section of Wildlife in March of 1977.

The program began with the appointment of the author as the supervisor of the nongame initiative and a budget of less than \$30,000 per year. In the 16 years that have elapsed since that modest beginning, the state nongame program has grown considerably. It is now a focal point for major initiatives in nongame wildlife management and restoration, biological surveys, forest songbird research, endangered species restoration, wildlife publications, habitat preservation, biodiversity conservation, and integrated resource management. In 1993, an annual budget of \$1,030,000 supported 148 different conservation projects.

## Organization

The NWP has a full-time staff of 12 persons and another 12 seasonal and part-time technicians and specialists. The nongame operations supervisor oversees general program direction, education, publicity, land acquisition, trumpeter swan restoration, and landscaping for wildlife initiatives. The nongame research acting supervisor is in charge of nongame research, surveys, federally funded research coordination, and shares the overall endangered wildlife species responsibilities with the nongame operations supervisor. The Nongame Program funds an environmental review position which is responsible for reviewing projects for impacts to endangered species and significant natural communities. The Program also funds a Natural Heritage Program botanist

position. The program secretary handles wildlife extension and information requests related to nongame, endangered species, nuisance wildlife, and rehabilitation.

Six regional nongame specialists are a significant key to the long-term success and accomplishments of Minnesota's program. Five of these persons were hired in 1982 and continue in those regional positions to the present. A sixth position for southeastern Minnesota was added in 1988.

The regional nongame wildlife specialists coordinate regional nongame and endangered species activities among other Minnesota DNR divisions such as forestry, parks, trails and waterways, waters, and enforcement. They also coordinate with field managers within the Section of Wildlife and Section of Fisheries. Responsibilities include local and regional educational programs and workshops, environmental review, networking with environmental groups,

involvement with regional and forest planning, evaluation of old forest and old growth stands, identification and acquisition of selected nongame habitats, coordination with nongame researchers, surveys of colonial waterbird, bald eagle and osprey nest sites, and maintenance of regional nongame data systems in coordination with the Natural Heritage data system in St. Paul.

Other initiatives include surveys of selected species like common loons, terns, loggerhead shrikes, Blanding's turtles, purple martins, and red-necked grebes. Promotion of bat conservation and the installation of gates at selected bat caves have also been carried out in eastern and southeastern Minnesota.

## Education

Project WILD and Aquatic WILD are both sponsored by the state NWP. Recent initiatives have included the publication of state supplements to Project WILD about Minnesota's deer management, and supplements for Blanding's turtle, exotic species, and bears.

Several portable learning stations have been developed or acquired for loan to schools through Project WILD, including those on loons, animal adaptations, timber wolves, and wetlands. Landscaping for wildlife habitat demonstration areas have also been developed at several state parks and areas.

## Habitat

Habitat initiatives are coordinated with the state Scientific and Natural Areas Program, Wildlife Management Area acquisition program, and private organizations like The Nature Conservancy and the



Among the many research projects initiated by Minnesota's Nongame Wildlife Program, the "wanted" posters are useful for soliciting information on little known species, such as the spotted skunk (*Spilogale putorius*). Graphic by Minnesota Nongame Wildlife Program.

**Table 1. Donations and acquisitions of land preserved by the Minnesota Nongame Wildlife Program during the last two years.**

	VALUE	SIZE	LOCATION
<b>DONATIONS</b>			
Sugar Lake Shoreline easement	\$117,200	78.4 acres	Itasca Co.
Jean Williams easement	\$318,756	205 acres	Carver Co.
Big Sugarbush Lake peninsula	\$ 18,500	17.8 acres	Becker Co.
Neudecker WMA	\$ 13,500	11.76 acres	Redwood Co.
<b>ACQUISITIONS</b>			
Bassbrook WMA		313.45 acres	Itasca Co.
Techout Island, Angle Island WMA		5 acres	Lake of the Woods Co.
Carmen Borgerding Island WMA		24.1 acres	Beltrami Co.
Dugdale Prairie WMA addition		160 acres	Polk Co.
Wig WMA		10.6 acres	Kandiyohi Co.

Trust for Public Lands.

Much habitat protection occurs as a result of coordination with DNR and County foresters through forest planning processes that include nongame and endangered species recommendations. The NWP has just produced a new brochure entitled "Woodlands and Nongame Wildlife" that is proving to be very popular with foresters and private landowners. Other significant habitat protection occurs as a result of the environmental review work that is done both at the regional level by the nongame specialists and in St. Paul. Habitat initiatives continue to be a focal point of nongame program activity. At the core of this effort is the Natural Heritage Information System for maintaining records of endangered, threatened, and special concern wildlife species.

In some cases where important nongame wildlife habitat does not fit the acquisition criteria of The Nature Conservancy, Wildlife Management Area (WMA) program, or Scientific and Natural Areas program, the Nongame Wildlife Program does acquire land for designation as Wildlife Management Areas. In two cases land easements have also been accepted. Table 1 summarizes the land preserved by the NWP in the last two years.

These land acquisitions have included important habitat for common terns (Techout Is.), bald eagles (Carmen Borgerding WMA and Sugar Lake shoreline easement), prairie chickens and sandhill cranes (Dugdale WMA), migra-

tory songbirds (Big Sugarbush Lake, Bassbrook WMA, and the Jean Williams easement), and herons and egrets (Wig WMA).

The total value of the land and easement donations, \$467,956, is being matched by bonding funds through the state's Reinvest in Minnesota Program and is used for the land acquisitions listed above. These totals are not reflected in the balance of the program budget figures because these efforts are self-supporting.

### Research

A total of 30 wildlife research projects were carried out in 1992. In almost all cases, initial support from the NWP has assisted researchers in raising additional funds from several of the 50 cooperative funding organizations who also participated in these projects. This is part of the key to effectiveness in carrying out nongame research as well as other NWP activities - networking for conservation. Many NWP projects lead to the development of partnerships which broaden the Program's organizational support and the funding base. In 1992, research projects focused on surveys and ecological studies of such diverse species and taxa as mussels, Forster's terns, dragonflies, wood turtles, prairie leafhoppers, common loons, Karner blue butterflies, boreal owls, piping plovers, black terns, migratory songbirds, cisco, prairie chickens and prairie voles.

Many research projects have been

initiated through a biennial grants program conducted by the NWP. This program serves to build the partnerships described above, attract students and other researchers to Minnesota, and influence the direction of research toward the priorities of the NWP. A major contributor of funding for the 1992 grants program was the DNR's Division of Parks and Recreation.

Federal endangered species funds have been

approved for 1993 for work on common terns, black terns, rare birds of the Mississippi River floodplain forest in southeast Minnesota, piping plovers, Karner blue butterflies, dakota and powesheik skipper butterflies, and red-veined prairie leafhoppers.

Several NWP staff were involved with the Leech Lake Band of Chippewa and the U.S. Fish and Wildlife Service in hosting a statewide meeting in December to discuss the status and management needs of the common tern in Minnesota. This meeting included a comprehensive discussion of strategies necessary for both protection and recovery of the state's dwindling common tern population.

"Wanted" posters have proven to be a useful way to generate preliminary distributional information on species for which little is currently known, and future research or a re-evaluation of status is planned. Last year this strategy was used to solicit black tern sightings from the public; this year sightings are being requested for spotted skunks.

A major initiative of the Nongame Wildlife and Natural Heritage Programs in 1993 is the revision of the state list of endangered, threatened, and special concern species, which has not been modified since it was first created ten years ago. A technique for evaluating a species' risk of extinction is being developed to assist this process. The goal is to have recommendations for changes to the list ready for the public review process by January 1 of 1994.

The focal project of Minnesota's nongame research effort is the Forest Bird Diversity Initiative. This long-term research and monitoring project was initiated in January of 1992. This cooperative effort involves many organizations and institutions, including the Natural Resources Research Institute of the University of Minnesota, Duluth, U. S. Forest Service, U. S. Fish and Wildlife Service, Environmental Protection Agency, National Fish and Wildlife Foundation, Minnesota Wood Promotion Council, Rajala Lumber Company, Rasmussen Millwork Inc., Minnesota Audubon Council, and the J. F. Bell Foundation, with primary funding from the Environmental Trust Fund (state lottery proceeds) at a level of \$500,000 per biennium.

The goal of this initiative is to develop landscape management tools to maintain the state's unique diversity of forest birds while accommodating the needs of the timber industry. This is the first comprehensive effort in the U. S. designed to gather data to develop forest management tools that integrate the diverse habitat needs of forest birds with other traditional forest management practices. It complements and builds upon other forest biodiversity projects being supported by the Nongame Program. (For a summary of this or other nongame research projects, write to Nongame Wildlife Program, Box 7, DNR, 500 Lafayette Rd., St. Paul, MN 55155.)

### Minnesota County Biological Survey

Effective natural resource planning, environmental review, endangered species protection and land acquisition depends on having high quality data about the distribution and abundance of species and natural communities. In many cases such data is old and incomplete. The Minnesota County Biological Survey (MCBS) is a systematic county-by-county inventory of significant natural areas, natural communities, rare plants and animals. The new data generated by the survey is entered into the Natural Heritage Information System. The MCBS animal surveys will utilize a field staff of 16 persons in



**Peregrine falcon (*Falco peregrinus*) chicks, like this one, are raised by falconers and released in the wild. Photo by Minnesota Nongame Wildlife Program.**

Houston and Winona counties in 1993. Target species this year include massasauga rattlesnake, wood turtle, Blanchard's cricket frog, black rail, loggerhead shrike, and Indiana bat.

This comprehensive strategy for surveying rare, natural features has yielded new state records, many new county records, and identified significant natural areas that were previously unknown to scientists. For example, MCBS surveys in five northwestern counties resulted in a 775% increase in state-listed bird records. Since MCBS began in 1987, over 4,400 locations of rare features have been discovered and added to the Natural Heritage Database by its staff. This represents 29% of the total number of rare features on the database. In addition, a total of 3804 potential natural areas have been identified. Of these, seven have become state Scientific and Natural Areas. Acting on MCBS findings, The Nature Conservancy recently purchased 7,148 acres of aspen parkland in Kittson and Roseau counties for transfer to the DNR. The site was identified as a protection priority because it is a large complex of relatively undisturbed natural prairie, and communities including fen, prairie, and brushland. Rare animal species inhabiting the site include timber wolf, sandhill crane, marbled godwit, yellow rail, and sharp-tailed sparrow.

Surveys have been completed in 20 of Minnesota's 87 counties. They are underway in five counties, and will be continued as funding allows. The biennial budget for the MCBS is \$1,549,000 and is derived from the state Environ-

mental Trust Fund, General fund, Reinvest in Minnesota funds, and nongame wildlife checkoff.

### Species Restoration

**Peregrine falcons.** From 1982 through 1989, a total of 189 peregrine falcon chicks were hatched in Minnesota, and 169 were successfully fledged. In 1992, ten pairs of falcons produced 30 chicks in the state. The peregrine falcon project has been a cooperative effort of the Raptor Center at the University of Minnesota, the Bell Museum at the U. of MN., the Minnesota Chapter of The Nature Conservancy, Minnesota Falconers' Association, U. S. Fish and Wildlife Service, U. S. Forest Service, and other organizations and individuals. The Nongame Wildlife Program has been the single largest funding source for the project. A total of \$130,000 has been spent on falcon restoration by the NWP since 1982.

**Trumpeter swans.** While the peregrine falcon restoration could depend on other similar restoration efforts for techniques and advice, the trumpeter swan restoration effort had to pioneer techniques ranging from bird transport and release strategies to wintering strategies and marking techniques. This project was also the first to obtain trumpeter swan eggs from Alaska. A total of 167 two-year-old swans have been released since 1987. Approximately one swan in four survives to mate and breed at the age of four. Last year eleven pairs of swans raised 29 cygnets in the wild. These swans are migrating to locations that range from west central Minnesota to Iowa, Missouri, Kansas and Nebraska. By releasing the swans in wetlands that completely freeze over in winter, this project has forced the swans to develop migratory traditions. Most of the swans have been released in the vicinity of the Tamarac National Wildlife Refuge in northwest Minnesota.

This has been a cooperative effort with the Dellwood Wildlife Foundation, The Trumpeter Swan Society, U. S. Fish and Wildlife Service, White Earth Band of Chippewa, Minnesota Zoo, Brookfield Zoo, Alaska Zoo, Hennepin County Parks and Delta Waterfowl Research



Station.

**Eastern bluebirds.** Bluebird restoration has been achieved through a cooperative effort with the Bluebird Recovery Program of the Audubon Chapter of Minneapolis. The Nongame Wildlife Program produced slide tapes, posters and sponsored workshops to initiate this project in the early 1980s. In 1982, a total of 150 volunteers reported raising 1490 bluebirds in their nest boxes. In 1992, there were 534 volunteers who reported raising 14,786 bluebirds—a tenfold increase in the past ten years. Many other birds like tree swallows, black-capped chickadees, house wrens, and white-breasted nuthatches have also benefited from this project.

### Wild Bird Recreation

Many of the early efforts to help nongame wildlife in Minnesota have focused on surveys, research, habitat management and preservation, and education. Efforts to work with the growing "wild bird" industry to promote the recreational aspects of birding, bird feeding, wildlife photography, placing nest boxes, and landscaping for wildlife are now being undertaken. The books *Woodworking for Wildlife* and *Landscaping for Wildlife* are part of that total effort. A total of 85,000 *Woodworking for Wildlife* books and 40,000 *Landscaping for Wildlife* books have been sold or distributed to date.

According to 1991 statistics from the U. S. Fish and Wildlife Service, over 1.9 million persons in Minnesota are "nonconsumptive" users of the fish and wildlife resource. Except for about 150,000 persons who make annual donations to the state nongame wildlife checkoff on the state tax forms, nonconsumptive users contribute little to funding the conservation of fish and wildlife/nongame/ or endangered species. The average contribution per year pro-rated to all users is \$.50 per year for support of wildlife conservation. In contrast, Minnesota anglers provide an average of \$15.00 per year for state conservation efforts through licenses, stamps, and excise taxes. Minnesota hunters pay an average of \$51.00 per year in licenses, stamps, and excise taxes

in support of state conservation projects.

Recent declines in nongame wildlife checkoff income have highlighted the need for a broader funding base for nongame/endangered wildlife species. A specific initiative for the benefit of wild birds is now being explored in cooperation with the International Association of Fish and Wildlife Agencies.

### Nongame Wildlife Checkoff

The nongame wildlife checkoff generated \$523,743 in 1980—its first year. Donations increased through 1988 when they hit a peak of \$1,072,451. A change in the state withholding formula caused a substantial drop in the number of taxpayers who received refunds in 1989, and that caused a drop in revenue to \$944,886. Since that time the donations have ranged from about \$950,000 to \$975,000. These funds accrue in the state "nongame wildlife management account" and are appropriated biennially for expenditure by the NWP, based on receipts for the previous two years and projections for the upcoming year. For tax year 1992 the donation rate is about 6.2% and the average donation is \$7.25.

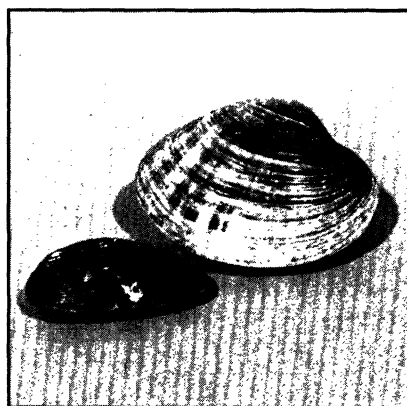
### Philosophy and Trends

During the first 16 years of the nongame wildlife program there have been many accomplishments that provide encouragement for the future. There have been successes with single-species

projects like peregrine falcons, trumpeter swans, and bluebirds. An exceptional data base has been built in cooperation with the Natural Heritage Program, and the Minnesota County Biological Survey has become a model for searching out new information on rare plants, wildlife and natural communities. The regional wildlife specialists have been successful at beginning to incorporate nongame/endangered species considerations into the fabric of Minnesota DNR management decisions regarding the management of forests, parks, wildlife management areas, and public waters.

Within the Minnesota DNR, resource management is slowly shifting from single species initiatives to broader community and ecosystem-level management strategies that require much greater nongame input through the agency's Integrated Resource Management and sustainability initiatives. Even the definition of nongame has changed. Initial program efforts dealt primarily with birds, mammals, reptiles and amphibians. Now there are projects to learn more about mussels, butterflies, caddisflies, prairie invertebrates, fishes, and other species that are important components of Minnesota's biodiversity. People are realizing that nongame species comprise the majority of species in our natural environments, but the state Nongame Wildlife and Natural Heritage Programs must become better funded and more deeply involved in broader resource management decisions in order to make the conservation of biodiversity a reality.

We expect to see the nongame/endangered species program continue to mature in the next decade as we tackle broader ecological management challenges like the preservation of Neotropical migrant songbirds and management of forest and stream biodiversity. The broad base of public support that we have experienced for our Minnesota Nongame Wildlife Program and the income tax checkoff provide hope and optimism for future progress.



**Mussel surveys on the state's rivers have yielded much new information about distribution and status of endangered mussels such as this Higgin's eye pearly mussel, (*Lampsilis higginsii*). Photo by Minnesota Nongame Wildlife Program.**

Carrol L. Henderson is the supervisor for the Minnesota Nongame Wildlife Program. He can be contacted at Box 7, 500 Lafayette Road, St. Paul, MN 55155; Tel. (612) 296-0700.

# Technical Note

## Tracking Contaminants in Fish, Wildlife and on Refuges with the BEST Program

by Valanne Glooschenko

Environmental contaminants from urban, agricultural and industrial sources are seriously threatening the nation's fish and wildlife populations. Billions of pounds of toxic chemicals are released annually into the air, water and lands of the United States. Exposure to these chemicals is affecting many of the trust resources of the U.S. Fish and Wildlife Service (USFWS). These include more than 91 million acres of National Wildlife Refuge lands and associated biota, as well as migratory birds, endangered species, anadromous fish, marine mammals and their respective habitats.

### A New Biomonitoring Program

USFWS has been monitoring contaminant levels in certain indicator species since the mid 1960s under the National Contaminants Biomonitoring Program. However, the expanded range of contaminant impacts affecting fish and wildlife populations today has required a new approach to this serious environmental problem. The Service's new Biomonitoring of Environmental Status and Trends (BEST) Program will identify, monitor, and respond to the effects of contemporary environmental problems associated with fish and wildlife resources.

The goals of the BEST program are to:

1. Determine the status and trends of environmental contaminants and their effects on natural resources;
2. Identify and assess the major factors affecting fish and wildlife resources and provide current and predictive information to alleviate impacts;
3. Provide summary information in a timely manner to managers and the public to guide conservation efforts.

Successfully achieving BEST's goals will answer many questions, such as: What contaminants are affecting National Wildlife Refuges and what are

the pathways and probable contaminant sources? What are the major contaminant threats to USFWS Trust Resources (e.g., migratory species, endangered species, anadromous fish, selected marine mammals)? Which Trust Resources are degrading or improving on a national, regional, and local scale?

### Program Concepts and Components

The BEST Program will use a comprehensive ecosystem-based approach to address the transport, fate and effects of contaminants on trust resources. A national biomonitoring network will be established which will evaluate impacts at tissue, organism, population, community and ecosystem levels.

The BEST program will utilize four bioassessment techniques or pathways of investigation:

1. Ecological Surveys will be used to assess changes in composition, structure, and function of plant and animal communities.
2. Biomarkers such as physiological anomalies will be utilized to measure fish and wildlife exposure to contaminants.
3. Bioassays and Toxicity tests will measure the relative species response to contaminant exposure in natural systems.
4. Residue Analysis will determine the ecological pathways and prevalence of various contaminants.

Partnerships for the acquisition of high quality data and information, in a cost-effective manner, will be important in facilitating effective operation of the BEST Program. Inter-agency coordination between the BEST Program and monitoring programs of the U.S. Environmental Protection Agency, U.S. Geological Survey, and National Oceanic and Atmospheric Administration is currently underway.

Initial steps have been completed in progress toward the BEST Program's full implementation (anticipated in Fiscal Year 1996). Pilot projects currently underway in 1993 include:

1. Field evaluation and interpretation of selected BEST methodologies at units of the Klamath Basin National Wildlife Refuge, California and Oregon.
2. Testing method/protocols for air quality monitoring in the Alaska Maritime National Wildlife Refuge, Tuxedni Wilderness Area, Alaska.
3. Monitoring the Trust Species component: Bald eagles and their habitat in the Great Lakes region.
4. Test of the repeatability of the Contaminants Monitoring Manual at the Laguna Atascosa National Wildlife Refuge, Texas.

The BEST program is the only federal biomonitoring program that will document the current level of impacts to the nation's fish and wildlife resources in a predictive and action-oriented manner. Working with other federal biomonitoring agencies, the information produced by the BEST Program will support numerous federal, state, and local efforts to prevent and address contaminants-related impacts to fish and wildlife.

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Valanne Glooschenko is a Regional Biomonitoring Coordinator for the U.S. Fish and Wildlife Service (USFWS), in Atlanta, GA. For further information, please contact one of the following Regional Biomonitoring Coordinators: Jim Coyle, Region 1, USFWS, Eastside Federal Complex, 011 NE 11th Ave., Portland, OR 97232-4181; Bryan Pridgeon, Region 2, USFWS, 500 Gold Ave., SW, P.O. Box 1305, Albuquerque, NM 87103; Tim Bartish, Region 3, USFWS, Bishop Henry Whipple Federal Bldg., Fort Snelling, 1 Federal Drive, Twin Cities, MN 55111; Valanne Glooschenko, Region 4, USFWS, 75 Spring St., SW, Atlanta, GA 30303; Laurie Richardson, Region 5, USFWS, 300 Westgate Center Drive, Hadley, MA 01035-9589; Larry Gamble, Region 6, USFWS, 134 Union Blvd., 4th Floor, P.O. Box 25486, Denver, CO 80225; Wayne Crayton, Region 7, USFWS, 1011 East Tudor Rd., Anchorage, AK 99503.

# Book Reviews

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## **Animal Biomarkers as Pollution Indicators**

By David Peakall. 1992.

Chapman and Hall. New York. \$75.50 cloth. 291 pp.

Over the last decade, conservation biology has emerged as a legitimate scientific discipline focusing on conservation of species and ecosystems. Unfortunately, the effects of toxic pollutants on species and ecosystems has received scant attention in much of the conservation biology literature. With some exceptions (e.g. DDT, selenium) environmental toxicologists have often failed to deal with the ecological and conservation implications of toxic pollution. Until the fields of conservation biology and environmental toxicology are more tightly integrated those concerned about both disciplines will have to integrate information from each field.

David Peakall's recent book, *Animal Biomarkers as Pollution Indicators* provides us with a source of toxicological information potentially useful for

conservation purposes. Beginning with a general introduction to hazard assessment, Peakall also provides chapters on biomarkers of toxic exposures for the nervous and reproductive systems. Biomarkers of genetic, hormonal, and immunological damage are also covered. Finally, chapters on the relationship between behavior and physiological changes and the use of biomarkers in environmental assessment are provided.

Development of biomarkers for toxic exposure is an important field of study, especially as it relates to environmental monitoring. Although Peakall's book does provide a general overview of the field, it does have several shortfalls. For example, while many of the tables and figures present a useful integration of information in a readily accessible format, the text is often simply a reiteration

Reviewed by David J. Zaber

of published studies without sufficient integration. In addition, certain important concepts such as what constitutes an adequate baseline or "control" environmental condition are given only cursory treatment.

Despite certain drawbacks, this book provides a useful introduction to the subject of biomarkers in animals. Nonetheless, given our understanding of human behavioral ecology, especially as it relates to resource use and abuse, it remains to be seen whether environmental monitoring using biomarkers will provide information truly useful for environmental management.

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David J. Zaber is a Ph.D. student in the School of Natural Resources and Environment at the University of Michigan. His research focuses on ecosystem-based environmental protection programs.

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## **Saving Our Planet: Challenges and Hopes**

By Mostafa K. Tolba. 1992.

Chapman and Hall. London. \$25.00 paper. 287 pp.

Mostafa Tolba focuses on the degrading conditions of the environment and the impacts of human activities, and how this has adversely affected our food, water and natural resources. He identifies the challenges and priorities we must undertake for our own sake as well as for future generations.

In Part I, the author provides an extremely useful summary of environmental problems related to air, soil and water pollution, climatic change, and loss of biodiversity. In Part II, he highlights the environmental impacts of development activities on food and agriculture, energy use, industry, transport and tourism. In Part III, he describes impacts of development activities on human health, population growth, human settlements, and peace and security concerns around the globe. In Part IV, he

presents the perceptions and attitudes toward environmental impacts and responses to upgrade and upkeep. In Part V, he focuses on some of the challenges and priorities for action to protect environmental quality, and to preserve and conserve natural resources.

Tolba rightly points out that human activities have reshaped the world's natural land cover. Indiscriminate destruction of forests and woodlands, the overgrazing of vegetation, and improper management of agricultural land, have all resulted in extensive degradation of land and biological resources.

On occasions, the author appears biased towards developed countries. For example, although advocating the principles of pollution prevention vital to waste reduction and prevention, he fails to point out those countries responsible

Reviewed by Shivaji Prasad

for disposing hazardous waste materials in developing countries. At certain places, the author has misrepresented facts and twisted the statistics, treating developing countries as scapegoats by ascribing irrelevant factors as causes of environmental degradation.

The text has been researched extensively citing over 450 current references. Technically, the color contrast in certain figures may be confusing to readers. However, overall, the text presentation is excellent, and this book may serve as a great resource for introductory-level teaching and referencing.

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Shivaji Prasad is a Ph.D. Candidate in the School of Natural Resources and Environment at the University of Michigan. He is applying his expertise in agriculture, remote sensing, and geographic information systems to solving water resource/environmental problems.

# Bulletin Board

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## Endangered Species Reauthorization Bills

The following is an annotated list of current bills introduced in this Congress dealing with reauthorization of the Endangered Species Act (ESA). H.R. 2043, The Endangered Species Act Amendments of 1993; introduced by Gerry Studds, John Dingell, and Jim Saxton; 69 co-sponsors. S. 921, The Endangered Species Act Amendments of 1993; introduced by Max Baucus and John Chafee; 14 co-sponsors. H.R. 1490, Endangered Species Act Procedural Reform Amendments; introduced by Billy Tauzin and Jack Fields; 50 co-sponsors. H.R. 1992, Endangered Species Improvement Act; introduced by Bob Smith; 12 co-sponsors. H.R. 1414, Human Protection Act; introduced by Hansen; 21 co-sponsors. H.R. 2207, Common Sense Amendments; introduced by Brewster; 5 co-sponsors. H.R. 888, bill to amend the Endangered Species Act of 1973; introduced by Fields; 3 co-sponsors. Bills H.R. 2043 and S. 921 would result in a strengthened reauthorized Endangered Species Act, and are the bills supported by the Endangered Species Coalition, a group of over 70 environmental organizations working for ESA reauthorization. Some of

the organizations in the Coalition are the American Association of Zoological Parks and Aquariums, Defenders of Wildlife, Environmental Defense Fund, National Audubon Society, Natural Resources Defense Council, Sierra Club and The Wilderness Society. Watch for an analysis of the current endangered species bills in an upcoming article in the *UPDATE*.

## "Ecosystem" Issue, 2nd Printing, Now Available

Due to popular demand, a second printing of the *Special Issue* of the *Endangered Species UPDATE*, entitled, "Exploring an Ecosystem Approach to Endangered Species Conservation" is now available. This issue contains 13 articles and an introductory note by authors from universities, conservation organizations and government agencies that address the theory and implementation of the ecosystem approach to protecting biodiversity. The *Special Issue* tackles ecosystem approach questions within three sections: Science and Management, Policy, and Education. Unique and timely in its coverage of an emerging approach to conservation, the *Special Issue* offers great material for policy

planning and training sessions, courses, and discussion.

Single copies of this 62-page issue can be purchased for \$6.00 (including postage). For orders of 20 or more, the price is \$5.00. For orders outside the U.S., please add \$1.00 per issue for shipping. Send check or money order (payable to The University of Michigan) to the *Endangered Species UPDATE*, School of Natural Resources and Environment, University of Michigan, Ann Arbor, MI 48109-1115.

## 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. ESA Reauthorization bills information from Endangered Species Coalition Monthly Update.*

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# Endangered Species UPDATE

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