

The U.S. Department of the Interior (DOI), the U.S. Department of Agriculture (USDA), and Mexico's *Secretaría de Medio Ambiente, Recursos Naturales y Pesca* (SEMARNAP, or Secretariat of Environment, Natural Resources, and Fisheries) have been cooperating to manage important species and habitat, forestry, and certain natural protected areas along the border for more than 60 years, starting with the signing of the 1936 Migratory Bird Treaty. The U.S.-Mexico Border XXI Program Natural Resources Workgroup—for which DOI and SEMARNAP have the coordination lead—has provided one more avenue for binational communication and cooperation.

The natural resource projects discussed in this chapter were not necessarily initiated under the Border XXI Program, but they are consistent with objectives identified in the *1996 U.S.-Mexico Border XXI Program: Framework Document (Framework Document)*. Consequently, the Natural Resources Workgroup uses Border XXI to report on ongoing binational and domestic projects that are consistent with program objectives. While this chapter does not provide an exhaustive account of all natural resources activities along the border, the projects described herein do represent efforts in conservation and sustainable use of natural resources in the border area that have been strengthened by binational cooperation.

OVERVIEW OF THE PRINCIPAL ISSUES AND THEMES

The Natural Resources Workgroup focuses on biodiversity and conservation, as well as sustainable management and restoration of natural resources in the border area. From these topics, the workgroup identified three areas of interest for its work: biodiversity and protected areas, conservation of forests and soils, and marine and aquatic resources. The workgroup also has provided a forum for identifying common problems in conservation of ecosystems on the border and for providing possible solutions to these problems through the participation of other workgroups.

The principal issues and themes for the Natural Resources Workgroup include:

- Protecting threatened biological resources
 - Reducing the threat of destructive wildfires along the border
 - Maintaining healthy ecosystems for people, plants, and wildlife
 - Measuring progress of the Natural Resources Workgroup's activities

Protecting Threatened Biological Resources Biodiversity and Protected Areas

From the coastal wetlands along the Gulf of Mexico to the Pacific Ocean, the areal extension and diversity of species being reduced, and important ecosystems and habitats are shrinking. Diversion of water, competition with livestock, and population growth are among the mounting threats to sensitive habitats and migration routes. Border XXI recognizes the need to conserve biological resources in the border region, particularly special status species and hundreds of neotropical migratory species. Establishing and improving management of adjacent natural protected areas along the border, where important resources are concentrated, is critical to this effort, and government agencies have placed increasing emphasis on those activities. Some of the best opportunities to improve rangeland, water, and wildlife management lie in the protected areas on both sides of the border in the Sonoran and Chihuahuan deserts.

There are also opportunities in the adjacent protected areas to develop new programs in ecotourism and help promote sustainable economies.

Forest and Soil Conservation

Other key natural resource management issues are maintaining and improving the health of forests and soils, completing land use planning, improving cross-border wildland fire management (see the discussion of the wildfire issue below), and expanding cooperative research and data exchange.

Natural Resources



Marine and Aquatic Resources

Freshwater and marine ecosystems in the border region are habitat for a variety of listed species. The rapid growth of rural and urban communities has particular impact on aquatic and marine environments, because unchecked growth can lead to the degradation of water resources. Contamination of habitats, introduction of exotic species, and losses from illegal extraction of species have become serious issues in the border region.

Reducing the Threat of Destructive Wildfire along the Border

The U.S.-Mexico Borderlands Wildfire Protection Agreement was signed in Mexico City by DOI, USDA, and SEMARNAP on June 4, 1999. It establishes a zone of mutual assistance along the border in which resources of either nation can cross the border to fight wildfires. Operating plans will be developed locally by field offices and other offices responsible for firefighting. The U.S. National Interagency Fire Center in Idaho is taking the lead in providing guidance for development of the local operating plans. The current issue is how to effectively implement the agreement and reduce the threat of destructive wildlife along the border.

Maintaining Healthy Ecosystems for People, Plants, and Wildlife

The interactions between sustainable natural resources and humans are complex and difficult to quantify. An underlying premise of Border XXI is that protection and restoration of habitat for wildlife species can be compatible with sustained growth of human economies. Developing an understanding of the carrying capacity of the environment is an essential step toward sustainability. Many of the projects supported by the Natural Resources Workgroup assess the life histories and needs of a variety of species and thereby help to determine the carrying capacity of ecosystems. Several of those projects are described in the following section of this chapter.

Measuring Progress of the Natural Resources Workgroup Activities

The indicators developed by the Natural Resources Workgroup are intended to measure real changes in the border ecosystems, but such measurements remain problematic for the workgroup. The objectives of the workgroup over the

next few years are centered on gathering data and developing the tools and relationships to support binational resource management on the border. Results often will be measured in terms of program development. Consequently, most of the current indicators are program indicators. The indicator measuring quantity of habitat restored, improved, or receiving increased protection is the only environmental indicator.

Effective environmental indicators depend on the availability of appropriate data, including limited baseline information about many border wildlife and vegetation species. In many cases, data bases have not yet been developed to track and manage the information. Some of the studies and projects being funded or otherwise supported by DOI will establish the necessary data bases over the next few years. For example, a project funded by DOI and begun in fiscal year 1999 is a synthesis and analysis of current habitat conservation activities along the border. Additional periodic assessments of changes in habitat are needed for a variety of species along the border. These indicators will eventually provide a valuable indicator of progress toward habitat protection.

OBJECTIVES OF THE NATURAL RESOURCES WORKGROUP AND PROGRESS TOWARD GOALS

In the *Framework Document*, the Natural Resources Workgroup identified management objectives focused on the following three areas: (1) biodiversity and protected areas; (2) forest and soil conservation; and (3) marine and aquatic resources. There are several subobjectives within the three main objectives. In these instances, the projects have been placed under the most representative goal.

Objectives:

- Improve and expand the protection of species and habitats in the border zone through management of protected areas.
- Increase scientific knowledge and training and promotion of legislation and new conservation methods.
- Promote sustainable resource management that improves the quality of life of border communities.
- Operate and administer the natural protected areas to guarantee the conservation of biodiversity and ecosystems.
- Improve and expand capacity in management and conservation of resources, environmental education, and legislation.
- Improve law enforcement for protection of special status species.

Improve and Expand the Protection of Species and Habitats in the Border Zone Through Management of Protected Areas

- The Sonoran Institute has conducted workshops on the restoration of riparian habitats of the Santa Cruz River, an important riparian corridor for neotropical migratory birds in southern Arizona and northern Sonora. The workshops have been primarily focused on the landowners and communities along that river.
- The critical habitat for migratory birds and other wildlife provided by the riparian areas along the Upper San Pedro River in Sonora and Arizona was recognized in the 1998 Commission for Environmental Cooperation report *Sustaining and Enhancing Riparian Migratory Bird Habitat on the Upper San Pedro River*. A binational team has been established to identify common needs and priorities in the upper basin. As a result of binational interest in the conservation of this ecosystem, SEMARNAP and DOI made a joint declaration in June 1999 to strengthen cooperation and establish mechanisms to improve and conserve the natural and cultural resources of the upper San Pedro River basin. Mexico has begun studies on the establishment of a natural protected area.
- In 1998, the DOI U.S.-Mexico Border Field Coordinating Committee published two resource guides in support of its work in the upper San Pedro River basin. The guides, *The Upper San Pedro River Basin of the United States and Mexico*, a resource directory and an overview of natural resource issues confronting decision-makers and natural resource managers, and *San Pedro and Santa Cruz Rivers Resource Directory*, provide a comprehensive listing of community and agency contacts working on the upper basin, as well as other useful information.
- Resource preservation and education partnerships have been established among Chiricahua National Monument, Coronado National Memorial, and Fort Bowie Historical Site in southeast Arizona and the *Reserva Forestal Nacional* (national forest reserve) Sierras de los Ajos, Buenos Aires, y La Púrica in northeast Sonora. The project, which started as a cross-border comparative natural fire landscape study, has grown into a broad resource management and protection partnership. The protected areas share similar sky island ecosystems (small mountain ranges in the desert that contain unique habitats),

and the partners are now cooperating in their work on management planning, grant applications, interpretation, prescribed fire management, and facility and education planning. Monitoring of fire effects on burn plots is continuing and has already improved prescribed burn planning, education, and recreation facilities. The partners are also continuing to survey bats, reptiles, and birds.

- The recovery and conservation of the Sonoran pronghorn (a type of antelope) is a key project for the Sonoran Desert partners: SEMARNAP/*Instituto Nacional de Ecología* (INE, or National Institute of Ecology), the *Instituto del Medio Ambiente y el Desarrollo Sustentable del Estado de Sonora* (IMADES, or Sonora Institute for the Environment and Sustainable Development), the *Reserva de la Biosfera* (biosphere reserve) El Pinacate-Gran Desierto de Altar, the Cabeza Prieta National Wildlife Refuge, Organ Pipe Cactus National Monument, and the Arizona Game and Fish Department. These partners, along with other organizations, are members of the binational recovery team for the Sonoran pronghorn. The recovery team is working to establish and maintain separate, viable pronghorn populations in the United States and Mexico. In addition, the Sonoran Desert partners are cooperating to develop population censuses and habitat assessments and to collect data on life histories. This ambitious effort has been supported by the 1997 letter of intent between DOI and SEMARNAP for cooperation in management of border protected areas.
- Excellent progress has been made on a cooperative binational project to manage and research species of mutual concern in the Río Grande region, which includes Big Bend National Park, the *Áreas de Protección de Flora y Fauna* (flora and fauna protected areas) Maderas del Carmen and Cañón de Santa Elena, Big Bend Ranch State Park, and Black Gap Wildlife Management Area. A regional population study has been completed, and monitoring of the peregrine falcon continues. In addition, scientists have begun to study black bear genetic diversity, to inventory fish in U.S.-Mexico contiguous protected areas at the Río Grande, and to determine the status of the Big Bend mosquito fish.
- Scientists are studying habitat suitability and population in the wetlands of the lower Colorado River of the

Yuma clapper rail, an endangered bird. The primary objectives are to determine the habitat used by the clapper rail, the changes in population and its demographics, and the extent of selenium contamination in eggs. A preliminary survey was completed in 1998. Additional results will be available over the next two years. Partners on the study include the U.S. Fish and Wildlife Service (FWS), DOI; the Arizona Game and Fish Department; the University of Arizona; SEMARNAP/INE; the Sonoran Institute; and others. These partners continue the studies in 2000 and will expand the study to include other aquatic life and birds of the wetlands.

- Genetic studies have been conducted on the Gould's turkey, a common species found in the Sierra Madre Occidental of Mexico and in Arizona. Turkeys have been transferred from Chihuahua and Sonora to the Huachuca Mountains and the Galviro Mountains in Arizona. Although the project has been concluded, the Arizona Game and Fish Department will continue to support studies and monitor the species in Mexico. Projects are jointly funded by the Wild Turkey Federation; the Forest Service (USFS), USDA; and the Arizona Game and Fish Department.

Other habitat and species studies in which the Natural Resources Workgroup is directly involved include:

- The Arizona-Sonoran Desert Museum and its partners have conducted a study of diversity and threats to ironwood habitats to compare the uniqueness and vulnerability of ironwood in Pima County, Arizona with those in other areas of the Sonoran Desert. Ironwood habitats, which are considered "old growth" forests of the Sonoran Desert, are being overexploited and are dwindling in size. The results of this project are available from the Arizona-Sonoran Desert Museum.
- Between 1991 and 1999, officials authorized and imported from Texas to Nuevo León a total of 594 white-tailed deer, 20 mule deer, and 381 wild turkeys. These surplus wildlife resources of Texas were imported to repopulate areas or to improve the density of populations of these species on private ranches. The ranches, designated as *Unidades de Manejo y Aprovechamiento Sustentable de la Vida Silvestre* (UMAS, or Units of Manage-

ment and Sustainable Use of Wildlife), are established in the border zone of Mexico, where the species are distributed. The UMAS owners financed the cost of capturing, permitting, and transporting the species. Government wildlife officials will continue to import surplus wildlife from Texas to Mexico.

- In 1997, Mexico conducted aerial surveys of the Sonoran pronghorn in Baja California, Sonora, and Chihuahua to register geographic location, size, and population structure. The principal activities underway in pronghorn territory were also classified. Similar surveys were conducted in 1998 in Coahuila. In addition, habitat and the abundance of predators (coyotes) were evaluated in the area of La Perla, Camargo, and an evaluation was initiated in the zone of Socco, Chihuahua.

Inspections were carried out to locate new groups of pronghorn and to evaluate habitat conditions. Significant pronghorn populations were identified in Chihuahua. The most important areas of the pronghorn population in Sonora were located, and the principal factors that impact that population were identified.

- In Mexico, ecological and demographic studies are being conducted on the Sonoran pronghorn, the bighorn sheep, the black bear, ironwood, and mesquite for conservation, recovery, and sustainable use—a concept that is fundamental to the UMAS.

- Through the establishment of UMAS, scientists are identifying habitats for priority species, such as the bighorn sheep, the black bear, the pronghorn, ironwood, and various cacti. More than 1,600 UMAS have been established in the Mexican border states to help conserve and manage species that require special protection.

- DOI is supporting a survey of threatened and endangered species on tribal lands along the border. Scientists and tribal representatives are documenting special status species, counts, habitat surveys, and life histories on the Cocopah and Pasqua Yaqui Indian reservations. A workshop on the project is planned this year.

Increase Scientific Knowledge, Training, Promotion of Legislation and New Conservation Methods

- Natural resources managers in the Western Sonoran Desert are cooperating on an extensive project to

improve protected area management with the use of geographic information system (GIS) tools. Various federal and state agencies, including the U.S. Air Force, are working with personnel from the biosphere reserves El Pinacate-Gran Desierto de Altar and Alto Golfo de California to provide training on GIS equipment, improve data bases, develop regional maps, and acquire equipment for the reserves.

- DOI scientists are developing a gap analysis of the border area from Ciudad Juárez to Big Bend National Park, identifying the “gaps” where native animal species and natural communities are not adequately represented in the existing network of conservation lands. A data base containing biodiversity information has been produced. SEMARNAP is developing a similar gap analysis data base for border areas in Mexico, using the ongoing vegetation classification, protected area information, and biodiversity data.
- DOI, U.S. Geological Survey (USGS), the Environmental Information Resource (EIR) Workgroup, and Mexico’s *Instituto Nacional de Estadística, Geografía, e Informática* (INEGI, or National Institute of Statistics, Geography, and Information) are working to coordinate border zone aerial photography and to produce base category mapping. The products of these efforts will be used as baseline maps for management of natural resources on the border. Soil mapping, vegetation mapping, and watershed mapping are some examples of how the base category mapping will be applied.
 - Full aerial coverage of the U.S. border zone has been completed. Partial coverage of the Mexican border zone has been completed, and work is continuing.
 - Digital elevation modeling of about 15 percent of the U.S. zone has been completed.
 - About 50 percent of the infrared digital orthophoto quadrangles in the U.S. zone have been completed. By the end of 2000, 80 percent of the quadrangle will be completed.

Future binational digital mapping and a variety of GIS applications will be built on the foundation of this important aerial photography.

- Scientists are conducting a binational study of contaminants in prey species in Big Bend National Park and

the flora and fauna protected area Maderas del Carmen. The work on peregrine falcons by the USGS Biological Resources Division and SEMARNAP is improving access to (1) ecosystem data and trends, (2) information about threats to biological diversity, and (3) ecosystem integrity.

- USGS, the National Park Service (NPS), the FWS, and other U.S. state and private partners are working in cooperation with the *Instituto Nacional de la Pesca* (National Institute of Fisheries), the *Procuraduría Federal de Protección al Ambiente* (PROFEPA, or Mexico’s Federal Attorney General for Environmental Protection), and SEMARNAP in Mexico to conduct nesting surveys of the endangered Kemp’s ridley sea turtles. Public education and increased beach patrols are having a positive effect on the ridley and loggerhead turtle populations.
- Scientists are mapping and evaluating vegetation in the riparian zones and wetlands in the Colorado River Delta. A data base will be developed with the information collected and will be used to (1) help in the analysis of vegetative response to the 1997 and 1998 floods and (2) support management decisions about neotropical migratory birds and other species of special concern.
- DOI is sponsoring a study to characterize flow of the lower Rio Grande, determine the instream flow and other habitat needs of native fish and riparian vegetation, and guide protective management actions along the river. Data collection has begun, and an initial report will be completed this year.
- The DOI Field Coordinating Committee has started a synthesis of current habitat conservation activities along the U.S.-Mexico border. The synthesis will identify data gaps in conservation, and will indicate where resources should be directed.

Promote Sustainable Resource Management That Improves Quality of Life of Border Communities

- Natural resources managers and local nongovernmental organizations in the western Sonoran Desert are working on several projects to encourage sustainable ecotourism and educate local communities, such as bilingual educational materials about the ecology and natural protected areas of the western Sonoran Desert, a video on the lower Colorado River ecosystem, and a wildlife viewing tower in Ciénaga de Santa Clara, an

important wetland in the biosphere reserve Alto Golfo y Delta del Río Colorado. The purpose of these projects is to raise public awareness and support for the conservation of the western Sonoran Desert.

- Tour operators, residents, land managers, and conservationists have established La Ruta de Sonora Eco-tourism Association (La Ruta), a non-profit organization to promote ethical and community-based economic development. The organization encourages visitors to use natural protected areas in a sustainable manner, provides benefits to local communities adjacent to the protected areas, and directs dividends to conservation priorities. Even though La Ruta is not a formal part of the Natural Resources Workgroup, the objectives of the organization are consistent with those of the workgroup, and the workgroup supports La Ruta activities.

Operate and Administer the Natural Protected Areas to Guarantee the Conservation of Biodiversity and Ecosystems

- At the end of 1997, park rangers from Big Bend National Park and personnel from the flora and fauna protected areas Maderas del Carmen and Cañón de Santa Elena conducted the first joint patrol of the Rio Grande. The river patrols take place on raft to access remote areas and enable rangers to inspect the state of natural resources while checking on visitors. The patrols help to spread the message of the importance of protecting the river to communities located in the natural protected areas and along the river.
- SEMARNAP has been working to provide basic personnel, equipment, vehicles, and financial resources and develop and implement natural resource management plans in the six natural protected areas on the border. Four natural protected areas already are operating with management plans.
- Two meetings in each of the two pilot regions of the Sonoran and Chihuahuan deserts were conducted as a direct result of the issuance of the DOI-SEMARNAP Letter of Intent to Enhance Cooperation in Adjacent Natural Protected Areas (LOI).

The Sonoran Desert pilot region includes:

- Organ Pipe Cactus National Monument
- Cabeza Prieta National Wildlife Refuge
- Imperial National Wildlife Refuge
- Special management areas administered by the Bureau of Land Management
- Biosphere reserve Alto Golfo de California y Delta del Río Colorado in Baja California and Sonora
- Biosphere reserve El Pinacate Gran Desierto de Altar

The Chihuahuan Desert pilot region includes:

- Big Bend National Park in Texas
- Big Bend Ranch State Park in Texas
- Blackwater Gap Management Area in Texas
- Flora and fauna protected areas Maderas del Carmen in Coahuila
- Flora and fauna protected areas Cañón de Santa Elena in Chihuahua
- Representatives of the various natural protected areas; federal, state, and municipal agencies; nongovernmental organizations (NGO); and universities and members of indigenous communities participated in the binational meetings. Projects of common interest were established between the adjacent natural protected areas. Various projects have been carried out, including (1) the exchange of personnel, (2) the implementation of training capacity-building activities, and (3) the development of inventories of species and cultural resources.
- The wetlands of the Alto Golfo de California y Delta del Río Colorado were included on the 1996 list of important international wetlands (the Ramsar Convention), which will heighten public awareness of the importance of the wetlands. Different entities are working to protect the wetlands through studies, monitoring, and improved coordination. The International Boundary and Water Commission (IBWC) established a fourth task force on the delta of the Colorado River. On May 18, 2000, DOI and SEMARNAP issued a *Joint Declaration to Enhance Cooperation in the Colorado River Delta*.

Improve and Expand Capacity in Management and Conservation of Resources, Environmental Education, and Legislation

- Two training courses in protected area management

are presented each year (one each in the United States and Mexico) for natural protected area personnel. Course topics include education about natural resources law enforcement in protected natural areas, ecotourism, and general resource management. NPS, INE, and Profau-na, A.C., are the principal supporters in implementing the course.

- The Sonoran Institute, DOI, SEMARNAP, and IMADES have been holding workshops with landowners and communities along the Santa Cruz River in Sonora to develop a community-based approach to the restoration of desert vegetation in the Santa Cruz basin in the United States and Mexico. A compendium of ecological activities in the area has been published and is available from the Sonoran Institute.
- Project Diablos is a program that has increased the binational capacity to manage wildfires in the border protected areas in the Big Bend-Maderas del Carmen-Cañón de Santa Elena region. NPS organizes and regularly presents a basic firefighter course for Mexican firefighters. The binational wildfires agreement, signed recently by the U.S. Secretary of the Interior, the Secretary of SEMARNAP, and the Undersecretary of Agriculture, will provide additional opportunities for cooperation in training and firefighting in the area.
- Staff of adjacent protected areas in the western Sonoran Desert, the NPS, FWS, and INE held a binational workshop in restoration practices and techniques for riparian and desert habitats. The following activities were included in the program: a desert restoration workshop in 1998; a riparian habitat restoration project in the Ciénaga El Doctor of the biosphere reserve Alto Golfo de California y Delta del Río Colorado and in the Martinez Marsh wetlands of the United States; a workshop on the restoration of riparian habitat in the Colorado River delta; and a binational workshop on management and restoration of the Colorado River delta in 1998.
- Two U.S.-Mexico border states conferences on recreation, parks, and wildlife were held in Hermosillo, Sonora and Tucson, Arizona in 1997 and 1998, respectively. Between 100 to 200 people involved in the conservation of borderlands natural resources attended the conferences to exchange information and present papers on

current research and activities.

- The Arizona Game and Fish Department and the *Centro Ecológico de Sonora* (Sonora Center for Ecology) conducted a Project WILD workshop in 1999. More than 30 teachers participated. Both organizations will begin an exchange program for environmental educators. In addition, the department conducted nine free educator workshops and trained more than 200 educators (classroom teachers and youth leaders) in Tucson, Yuma, and Nogales.

Improve Law Enforcement for Protection of Special Status Species

Activities in fulfillment of this objective were transferred to the Cooperative Enforcement and Compliance Workgroup.

Activities conducted in this focus area include:

- Coronado National Forest and the national forest reserve Sierras de Los Ajos, Buenos Aires, y La Púrica have developed a sister forest program. To date, the program has succeeded in: (1) fighting several border area wildfires; (2) providing firefighting training sessions; (3) conducting studies of priority species, such as the Mexican spotted owl; and (4) providing education in natural resources management for the communities and *ejidos* (common lands) in the border zone. In 1998, with support from the U.S. Agency for International Development (USAID), national forest reserve Sierras de los Ajos, Buenos Aires, y La Púrica promoted the project Detection, Prevention, and Combating Forest Fires in Northeast Sonora. As a result, the staff of the national forest preserve installed radio communication equipment and a detection tower in the reserve and a cabin for the firefighting brigades.
- An evaluation was conducted of the potential risks that cross-border insects and diseases may pose to forests in the U.S.-Mexico border area. To reduce these risks, inspection activities are increasing. Forest protection personnel are being trained to identify insects and diseases along the border.

Forest and Soil Conservation

Objectives: Forest and Soil Conservation

- Encourage conservation and sustainable use of forest and rangeland resources through collaboration with local communities and public participation.
- Monitor and enforce regulations.
- Build links between research and resource management.
- Promote education at the local level.
- Undertake efforts to stop desertification and increase green areas by discouraging the use and consumption of certain flora.
- Ensure that proposed projects and activities that may adversely impact the use and conservation of natural resources are in compliance with environmental regulatory requirements.

To avoid introduction of disease at quarantine levels, SEMARNAP processed from 1996 to 1998 an average of 2,433 technical plant health requirements, under Mexico's sanitary regulations, for the importation of forest products and by-products. On average, 48 international plant health certifications were issued annually, guaranteeing the health quality of forest products and by-products for export to the United States.

In support of these activities, inspection personnel from PROFEPA in the northern border customs office made taxonomic determinations and gave decisions for 644 entomological and pathologic specimens from imported forest products. Other activities implemented by PROFEPA are presented in the Cooperative Enforcement and Compliance Workgroup chapter.

Other projects are:

- From 1996 to 1998, through Mexico's *Programa Nacional de Reforestación* (PRONARE, or National Reforestation Program), the Cooperative Enforcement and Compliance Workgroup completed the following restoration activities in Mexican border municipalities, using 88 different native species:
 - Collected 2,668 kilograms of germplasm (seeds)
 - Produced 7,364,353 plants
 - Planted 5,959,295 plants
 - Reforested 5,959 hectares
- In 1998, four border areas were declared ecological restoration zones affected by fires. Three are located in Cananea, Sonora, with a surface area of 676 hectares, and one is located in Arteaga, Coahuila, with a surface area of 5,100 hectares.

- During 1997 and 1998, voluntary practices for improving soil conservation and forest production in the border region of Mexico began with the implementation of the *Programas de Manejo de Tierras* (PMT, or Land Management Programs). In 1997, 147 PMTs were produced for 4,308 hectares. In 1998, 166 PMTs were produced for 4,171 hectares in Tamaulipas.

- USFS has presented several training programs related to the disease risk project described above. In 1998, five training courses were presented to Mexican technicians from SEMARNAP to improve verification of the health of imported Christmas trees and identify quarantine-significant diseases. SEMARNAP personnel were given additional training on health regulations.

- USFS, Pennsylvania State University, and SEMARNAP collaborated on a study of the impact of air pollution in the forests of the western and eastern regions of the U.S. and Mexico. In the first phase of the study, which concluded in 1998, cooperators developed standardized methods of measuring levels of ozone, nitrogen, and sulfur to identify pollution damage in forests. They also identified forest species that can be used as bio-indicators. The second phase of the study will be initiated in 2000.

- USFS and SEMARNAP are working together to establish a training program on best management practices for sustainable development. As part of the effort, the collaborators are promoting the involvement of resource producers from Ejido Bassaseachic, Chihuahua. A training course and the eventual publication of a manual of best management practices are planned.

- Two technical personnel from Ejido El Largo-Madera, Chihuahua, were trained in the use of equipment and software to digitalize information about forest resources. The USFS donated equipment and participated with SEMARNAP in the training and will continue to serve as advisor to the project.

- In 1996, the Arizona Game and Fish Department conducted a wildlife law enforcement undercover operations training for six PROFEPA wildlife officers. The group of managers will be the first wildlife law enforcement unit in Mexico dedicated solely to undercover operations.

Marine and Aquatic Resources

Objectives: Marine and Aquatic Resources

- Protect, conserve, and restore marine and freshwater ecosystems in the border area, with an emphasis on threatened and endangered species and their habitats.
- Promote sustainable aquaculture.
- Initiate training and education programs and outreach activities.
- Strengthen compliance with legislation and regulation.

Activities conducted in this focus area include:

- Mexico has carried out studies of marine species that have protected status, such as the totoaba and the vaquita, two species endemic to the upper Gulf of California, whose populations are in danger of extinction. Other activities include: management and planning for the maritime terrestrial zone; environmental impact evaluations; and outreach on the lower Colorado River, among others.
- In Mexico, coastal zone management was implemented through coordination in municipalities of the northern border through the *Programa Especial de Aprovechamiento Sustentable de las Playas* (Special Program of Sustainable Use of Beaches). Almost 85 kilometers of coastline was delineated in the *Zona Federal Marítimo Terrestre y Terrenos Ganados al Mar* (Federal Maritime and Terrestrial Zone).
- Within the framework of the Rural Aquaculture Program, initiated in 1995 by SEMARNAP, the principal aquaculture activities carried out with the states and municipalities on the border have consisted of repopulating small bodies of water, including rivers, streams, and watersheds. From 1995 to 1998, in the six border states in Mexico, 3.8 million fish were bred. Some border municipalities have carried out the fish breeding in tanks and small reservoirs, with that effort becoming the major aquaculture activity in Ensenada, Mexicali, Matamoros, Reynosa, Ascensión, Ciudad Juárez, Manual Benavides, Guadalupe, Acuña, Hidalgo, Anahuac, Agauleguas, Melchor Ocampo, China, and Treviño, among others. Likewise, larger dams, such as Falcón, R. Marters, Angostura, and La Amistad, have also benefitted.

ENVIRONMENTAL INDICATORS

The following accomplishments and data are grouped according to the appropriate indicator originally presented in the *1997 United States-Mexico Border Environmental Indicators Report (1997 Indicators Report)*. The number of accomplishments reported under each indicator does not represent all work performed in the border area. Indicator data from wildlife management agencies in California, New Mexico, and Texas were not available for inclusion here. Additional work is needed to develop data bases for all indicators that provide meaningful, well-defined baseline data that are easily collected on a regular basis.

Types of Environmental Indicators

P

PRESSURE: ACTIONS OR ACTIVITIES THAT INDUCE PRESSURE ON THE ENVIRONMENT

S

STATE: ENVIRONMENTAL AND NATURAL RESOURCE QUALITY AND QUANTITY

R

RESPONSE: ACTIONS TAKEN TO RESPOND TO ENVIRONMENTAL AND NATURAL RESOURCE PRESSURES

INDICATORS OF BINATIONAL COOPERATION IN RESOURCE INVENTORIES AND MANAGEMENT

R

NUMBER OF BINATIONAL RESOURCE MANAGEMENT INVENTORIES AND ASSESSMENTS FOR SOILS, VEGETATION, AND WILDLIFE

- At Organ Pipe Cactus National Monument, numerous species are being monitored, including 13 lizard species, 10 small nocturnal rodent species, 61 bird species, and 14 species of bats: 5 (counting only broad categories of species).
- Soil surveys have been completed in natural protected areas in the United States, including Chiracahua National Monument; Cabeza Prieta National Wildlife Refuge; Coronado National Forest; Organ Pipe National Monument; southern Cochise County, Arizona; the Ajo, Arizona area; and the southern portion of the Colorado River basin: 7.
- The Arizona Game and Fish Department collaborated on and/or funded (through Heritage grants, which are revenues from the Arizona State Lottery) projects to assess the status and ecology of shovel-nosed and

leafnose snakes in and near Organ Pipe Cactus National Monument. Other species inventoried include the desert Massasauga rattlesnake; the Mexican rosy boa; the Ajo Mountain whipsnake; the Huachuca tree; the Chiricahua and barking frogs; several bat species in the Buenos Aires National Wildlife Refuge; amphibian and reptile inventories at Sulphur Springs Valley, Whetstone mountains, and San Bernardino National Wildlife Refuge; and the Tarahumara frog, the flat-tail horned lizard, and thick-billed and maroon-fronted parrots in Mexico: 16.

- A partial list of studies in Mexico financed by INE of regional inventories of species and habitats includes the following: mammals of the northern border, inventory of flora and fauna of the marine coastal region of the northeast of the Gulf of California, status of beaver in the Mexicali Valley, inventory of the flora and fauna of Laguna Madre (a water body along the eastern coasts of Texas and Tamaulipas), biological diversity of the meadows or prairies of northeastern Mexico, land mammals of Baja California, and a reassessment of flora on the river banks and in riparian areas in the border area of the state of Sonora: 7.

- Additional studies of populations in Mexico include those of bighorn sheep, the Sonoran pronghorn, the black bear, and the marine turtle and inventories of ironwood and mesquite: 6.

- Current studies of species in natural protected areas in Mexico include those of the status of the Yuma clapper rail in the biosphere reserve Alto Golfo de California y Delta del Río Colorado, conservation and recovery of the pronghorn and ironwood habitats, the status of the desert pupfish in the biosphere reserve El Pinacate y Gran Desierto de Altar, and an inventory of vegetation in the flora and fauna protected area Cañón de Santa Elena: 5.

- Binational inventories have been reported by the USGS Biological Resources Division (BRD). An inventory of peregrine falcons at Big Bend National Park and the flora and fauna protected area Maderas del Carmen is in progress. Also in progress is the BRD gap program conducting vegetation analysis along the Texas-Mexico border: 2.

- Other inventories reported by both the United States and Mexico include: the Rio Grande riparian vegetation

analysis (and instream flow determination), vegetation mapping and habitat assessment of the Colorado River Delta, GIS work at the biosphere reserve El Pinacate-Gran Desierto de Altar and Organ Pipe Cactus National Monument, a black bear study at Big Bend National Park, an additional ironwood study, and beaver and fish inventories: 7.

- The Arizona Game and Fish Department conducted routine annual and semi-annual surveys of target species in the border area, including deer, the pronghorn, the bighorn sheep, the javelina, the white-winged dove, the Gambel's scaled and Mearns' quails, the turkey, the sandhill crane, and waterfowl: 10.

TOTAL NUMBER OF BINATIONAL INVENTORIES AND ASSESSMENTS FOR VEGETATION AND WILDLIFE: 56

R PERCENTAGE OF FULL COVERAGE OF SOIL SURVEYS, INVENTORIES OF SOIL USES, AND VEGETATION AND WATERSHED BOUNDARY MAPPING IN CROSS-BORDER PROJECTS

- USGS is directing a border area aerial mapping project. One hundred percent of the U.S. side of the border has been photographed. Watershed delineations at the 8-digit hydrologic unit code (watersheds from some 50,000 acres to 200,000 acres) are being prepared from digital elevation maps. Watershed mapping has been completed for approximately 2.2 percent of the border area on the U.S. side.

R NUMBER OF TRAINING COURSES AND WORKSHOPS IN NATURAL RESOURCE MANAGEMENT, LAW ENFORCEMENT FOR PROTECTION OF SENSITIVE SPECIES, AND OTHER ENVIRONMENTAL EDUCATION AND NUMBER OF PARTICIPANTS IN THESE TRAINING COURSES AND WORKSHOPS

- BLM provided GIS training to resource management staffs of border protected areas in Arizona. The emphasis was on establishing a common GIS system in biosphere reserve El Pinacate-Gran Desierto de Altar and biosphere reserve Alto Golfo de California y Delta del Río Colorado: 2.

- Two training courses were sponsored by NPS and INE and were given by Profauna A.C.: 2.

- As part of the exchange program in the adjacent natural protected areas in the western Sonoran Desert, a desert restoration workshop was held in 1998. Riparian habitat restoration projects were conducted in the Ciénaga El Doctor of the biosphere reserve Alto Golfo

y Delta del Río Colorado and the Martinez Marsh wetlands. A workshop on riparian habitat restoration in the Colorado River delta and a binational workshop on management and restoration of the Colorado River delta, were held in 1996 and 1998, respectively: 4.

- Additional NPS-sponsored training courses include the annual course Getting To Know Mexico (last offered in 1998) and a workshop on grazing management: 2.
- Two United States-Mexico border states conferences on recreation, parks, and wildlife were held in Hermosillo, Sonora and in Tucson, Arizona in 1996 and 1998, respectively: 2.
- Elementary school education in watershed resource management in the communities on the Rio Grande in west Texas and Chihuahua is being developed as a program for teachers: 1.
- An education program for children in three Sonoran desert communities, Puerto Peñasco, Sonora; Ajo, Arizona; and Hickiwan, Arizona on the Tohono O’odham Nation, has been jointly funded by BLM, NPS, the International Sonoran Desert Alliance, and the individual communities. Education and experience in recycling and international cooperation are provided: 3.
- The Arizona Game and Fish Department reports a variety of training sessions and educational workshops in the United States. They include a seminar on turkey research and management, and a variety of training sessions on management techniques for endangered species, including law enforcement. The total number of training programs is not available.

TOTAL OF COURSES AND WORKSHOPS, NOT INCLUDING THE SEVERAL ARIZONA GAME AND FISH DEPARTMENT TRAINING PROGRAMS: 18

R NUMBER OF COORDINATED, BINATIONAL RESPONSES TO FOREST FIRES AND OTHER WILDFIRES HAVING THE POTENTIAL TO CROSS THE INTERNATIONAL BORDER OR TO THREATEN SENSITIVE SPECIES HABITAT

The agreement between DOI, USFS, and SEMARNAP on border wildland cooperative fire management was signed in 1999. No fires have yet been reported on lands managed by agencies of DOI under the new management. A total of four fires meeting the criteria of this indicator were reported among the USFS accomplishments in the *Natural Resources Workgroup 1999–2000 Projects Report*. Cooperative

suppression of the fires was completed before the new agreement under an existing agreement between the USFS and SEMARNAP: 4 (fire prevention projects in the rural areas of Sonora and Chihuahua).

INDICATORS OF HABITAT AND SPECIES PROTECTION AND RESTORATION

R NUMBER OF SITES AND QUANTITY OF HABITAT IN PROJECTS, DESIGNATIONS, AND AGREEMENTS THAT HAVE INCREASED PROTECTION, RESTORATION, OR IMPROVEMENT OF NATIVE VEGETATION AND WILDLIFE SPECIES IN WETLANDS, RIPARIAN AND AQUATIC AREAS, FOREST LANDS, AND DESERT UPLANDS AND GRASSLANDS

- The Arizona Game and Fish Department reports six land acquisitions in four border counties in Arizona that have significantly increased protection on a total of 2,367 acres of aquatic and riparian habitat.
- A land acquisition by the FWS along the Lower Rio Grande River has recently been completed. New protection measures are being implemented.

R NUMBER OF PROJECTS IMPLEMENTED FROM RECOVERY PLANS, AGREEMENTS, AND OTHER RECOVERY EFFORTS FOR SENSITIVE FLORA AND FAUNA SPECIES

- The Arizona Game and Fish Department reports projects implemented from recovery and management plans and conservation agreements on the Gila topminnow; the desert pupfish; a variety of native fish in Sycamore Creek, Santa Cruz County; ranid frogs; the Sonoran desert tortoise; the flat-tail horned lizard; the New Mexico ridgenose rattlesnake; the Yuma clapper rail; the cactus ferruginous pygmy owl; the southwest willow flycatcher; the Sonoran pronghorn; and the jaguar; as well as bat management and development of the *Arizona Breeding Bird Atlas*; 14.
- The USGS BRD reports two ongoing projects associated with recovery plans: evaluation of environmental contaminants in Aplomado falcons and ocelots: 2.

TOTAL NUMBER OF REPORTED PROJECTS IMPLEMENTED ON THE BASIS OF RECOVERY PLANS AND AGREEMENTS: 19

OTHER NOTABLE ACTIVITIES AND ACHIEVEMENTS

Members of the Natural Resources Workgroup worked with members of the Water Workgroup and the International Boundary and Water Commission to plan the Rio Grande Symposium, a government-to-government meeting to discuss the low-water-flow-related stress on the Rio Grande-Río Bravo riparian ecosystem between Fort Quitman and Amistad Reservoir. The symposium was held on June 19, 2000 in Ciudad Juárez. The discussion focused on the riparian ecosystem of the adjacent protected areas of Big Bend National Park, Maderas del Carmen and Cañón de Santa Elena flora and fauna protected areas, and Big Bend Ranch State Park. Information and data on the current state of the hydrologic system, aquatic biological communities, water use, and water management practices were presented by those who have conducted studies on this reach of the river. Constraints and opportunities for change were discussed in an attempt to reach agreement about how to better manage water resources to improve conditions for habitat and wildlife.

FUTURE PERSPECTIVES

Cross-border cooperation on natural resources management issues is conducted under several fora, including Border XXI; the DOI-SEMARNAP letter of intent (LOI); and the Wildland Fire Protection Agreement among SEMARNAP, DOI, and USDA. The increasing number of government agencies, nongovernmental organizations, and tribal governments in the United States that are involved in cross-border natural resources cooperation is a strong indication that the level

of concern and awareness about these issues is growing.

The DOI-SEMARNAP LOI on adjacent protected areas has proved to be a valuable mechanism for cooperation because it has focused binational efforts on regional priorities identified for their high density of species and biodiversity. The first two pilots in the western Sonoran Desert and the Chihuahuan Desert were not the beginning of this type of cross-border collaboration, but the LOI has served to enhance the collaboration and partnerships.

In the western Sonoran Desert, regional leadership by both government and nongovernmental organizations has been key to carrying out a number of real, on-the-ground projects. The process has been driven by the local land managers, with strong participation by others outside the federal government. Nongovernmental organizations like The Nature Conservancy, the Sonoran Institute, and the Arizona-Sonora Desert Museum have been instrumental in providing some of the theoretical frameworks and analytical processes for defining overarching themes and issues. This level of collaboration, though still in a formative stage, will only grow stronger with time.

Cross-border collaboration is also improving in the Big Bend pilot region of the Chihuahuan Desert, where the staff of natural protected areas are working on some important on-the-ground projects. The next step for this region will be to agree on common priorities and mutual interests that can serve as overarching themes. Fire management and exotic and endangered species will be likely themes for further development.

The Natural Resources Workgroup looks forward to this level of cooperation expanding to other biodiversity hot spots on the border, such as the upper San Pedro River basin.