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Conservation Connections in a Fragmented Desert Environment: The U.S.-Mexico Border

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ABSTRACT

Natural resource agencies from the governments of the United States and Mexico, along with a number of non-governmental organizations, are forming conservation connections across the international border to protect their shared natural heritage in the transboundary Sonoran and Chihuahuan Deserts. But they face many challenges; population growth, water scarcity, jurisdictional barriers, and pressures from illegal immigration and narcotics smuggling are among the most pressing. Despite these challenges, many important binational projects are underway that will make a true difference in the long-term management of the natural resources of the border region.

INTRODUCTION

The international border that divides Mexico and the United States also unites the two countries in a shared cultural and natural history. This region has always been more infamous than famous; it was once known for its wild-west mentality, where people took the law into their own hands. Today, it is known for its urban explosion, crime, and pollution. The story that usually does not get told, however, is the story of how people on both sides of the border are working together to conserve the shared natural resources of this fragile desert environment. Cross-border partnerships between government agencies, non-governmental organizations (NGOs), and communities have become the essential tool of conservation efforts in the U.S.–Mexico border region.

Cross-border partnerships are critical to the conservation efforts in the U.S.–Mexico border region because of the enormous stress placed on transboundary ecosystems. The rapidly growing population and the North American Free Trade Agreement (NAFTA) have brought economic development to an arid, desert region already faced with scarce water

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resources. Jurisdictional lines and the political boundary divide ecosystems and habitats. The border region is comprised of a mixture of privately owned land and publicly owned land. Public lands are managed by the local, state, and national agencies of each country, and each agency manages land in a slightly different manner and for different purposes. Most alarmingly, illegal immigration and narcotics smuggling—and the efforts to control this illegal activity—are carving paths across the fragile desert floor.

Political factors provide an overlay to these pressures and add color to the cross-border conservation efforts. The Presidents and their Cabinet Secretaries charged with natural resources management have signed political statements and agreements that encourage the building of relationships across the border to solve common problems. The friendship between the U.S. and Mexican Cabinet Secretaries has filtered down to create improved relations between their staffs, who have further increased ties across the border. Yet, the economic disparity between the United States and Mexico is always an underlying factor. Because the two countries are at different levels of economic development, the people who live and work along the border are forced to meld different priorities and ways of doing things.

Border region land managers and conservation organizations are making great strides in overcoming these challenges, as evidenced in the binational work taking place in adjacent protected natural areas along the border. In the Western Sonoran Desert and the Big Bend area of the Chihuahuan Desert, natural resource managers, scientists, and researchers are carrying out cross-border projects in riparian and desert restoration, ecotourism and public outreach, wildlife management and research, geospatial data development, river protection, and wildfire management. This article describes the challenges facing these groups, how they are working together to overcome these challenges, and the highlights of the binational conservation cooperation in the border region.

DESCRIPTION OF BIODIVERSITY AND PROTECTED NATURAL AREAS

The Sonoran and Chihuahuan Deserts each cross the international border and harbor a vast diversity of wildlife and vegetation communities. The 1,952 mile-long border snakes its way across the lush coastal marshes of the Gulf of Mexico in the east to the volcanic craters of the Pinacate Biosphere Reserve in the west. There are north-south biological corridors that connect the Rocky Mountains in the north with the Sierra Madres Oriental mountain chain to the south. There are freshwater and marine ecosystems, wetlands, rangelands, and several types of forests in the border region, but the desert is the most prevalent type of ecosystem.

There are approximately 85 threatened and endangered species of plants and animals, and more than 450 rare or endemic species.[1] More than 700 neotropical migratory species (birds, mammals, and insects) use the borderland habitats during their annual migrations.[2]

Approximately one-third of the U.S. border territory is public land, largely managed by the U.S. Department of the Interior (DOI). These public lands include networks of protected natural areas (PNAs)[3] such as the PNAs in the Sonoran and Chihuahuan Deserts that form contiguous stretches of protected land and wildlife corridors between urban areas. The cross-border areas are separated from each other only by political and jurisdictional boundaries, and the implications for this are described further on in this article. The U.S. Forest Service and the state of Texas also manage a smaller portion of public land in the region. In addition, there are large expanses of undeveloped U.S. military lands and Indian Reservations such as the Tohono O'odham and the Cocopah Reservations.[4]

Gulf of Mexico and Lower Rio Grande Valley

Padre Island is a 180-mile-long barrier island in the Gulf of Mexico, on the eastern edge of the U.S.–Mexico border. The U.S. National Park Service manages about 70 miles of the island as a National Seashore. The island forms a barrier of natural protection for the ecologically important Laguna Madre, an intercoastal sea corridor fed by the delta waters of the Rio Grande. Extending from southern Texas into southern Tamaulipas, the Laguna Madre is home to the Kemps ridley sea turtle, one of the key species scientists from both countries are working together to protect. A string of U.S. National Wildlife Refuges along the delta of the Rio Grande in the Brownsville/Matamoros area of the Lower Rio Grande Valley provides a home to important migratory and resident wading birds. These refuges also contain wildlife corridors for mammal species shared with Mexico, such as the jagarundi and the ocelot.

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1. *See* ENVTL. PROTECTION AGENCY, U.S.-MEXICO BORDER XXI PROGRAM: FRAMEWORK DOCUMENT, at III.4 (1996).

2. *See id.*

3. For purposes of this article, a protected natural area will be referred to as a PNA. However, "protected natural area" is not an official designation.

4. There are 35 tribes within 50 miles of the border ranging in size from the Tohono O'odham Nation with over two million acres of reservation lands to the Out Reservation with 156 acres.

Rio Grande and the Chihuahuan Desert

The Rio Grande cuts across the Chihuahuan Desert and forms the international boundary from El Paso, Texas, to the Gulf of Mexico. Several important PNAs lie adjacent to the Rio Grande where the river makes a big bend, or dip, in the southern central part of Texas. Named accordingly, Big Bend National Park and Big Bend State Ranch share a border with the Maderas del Carmen Flora and Fauna Protected Area (FFPA) in Coahuila and the Santa Elena Canyon FFPA in Chihuahua. Together, these areas form the protected heart of the Chihuahuan Desert (see map 1 at the end of this article). The cross-border efforts in this area are discussed in greater detail in the section on Binational Efforts in Big Bend Country, infra.

Upper San Pedro River Basin

Beyond Big Bend country, at the intersection of the Chihuahuan and the Sonoran Deserts, lies the upper San Pedro River, one of the continent's most important flyways for migratory birds. Its headwaters are in Cananea, Sonora, and it flows north for 145 miles past the U.S. border, joining the Gila River at Winkelman, Arizona. Unlike other rivers in the region, "the overall health and quality of the upper San Pedro River and its riparian habitat have not declined significantly over the last century."[5]

The upper San Pedro River is one of the few perennial streams in the region and helps to sustain the basin's groundwater system. The San Pedro River basin is administered as a Riparian National Conservation Area by DOI's Bureau of Land Management (BLM). To protect other key areas of this transboundary watershed, Mexico is working to create a new protected natural area that would encompass its section of the San Pedro River basin.

The most pressing environmental challenge in the San Pedro valley is that the groundwater aquifer is being depleted faster than it can recharge, reducing the flows of the San Pedro River. Economic growth and development on the U.S. side of the border is causing water demand to exceed supply. As a result, a local/state/federal partnership has formed in the United States in an attempt to balance all the competing uses of the scarce water supplies. Although water use on the Mexican side of the San Pedro basin is less than that on the U.S. side, Mexico's willingness to designate their portion of the San Pedro basin as a PNA will lead to the increased cross-border collaboration needed to save this precious natural resource.

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5. COMM'N FOR ENVTL. COOPERATION, RIBBON OF LIFE: AN AGENDA FOR PRESERVING TRANSBOUNDARY MIGRATORY BIRD HABITAT ON THE UPPER SAN PEDRO RIVER 1 (1999).

WESTERN SONORAN DESERT

A large amount of land in the western Sonoran Desert on the U.S. side of the border is managed by the DOI, Department of Defense (DOD) and the Tohono O'odham Nation. The National Park Service (NPS) manages Organ Pipe Cactus National Monument (ORPI). The Fish and Wildlife Service manages Cabeza Prieta National Wildlife Refuge, and, in addition, there are a number of BLM-managed areas. The U.S. Air Force manages the Barry Goldwater Range. All of these areas just mentioned share borders with each other and with the *El Pinacate y Gran Desierto de Altar* Biosphere Reserve (*El Pinacate*) in Mexico. The Imperial National Wildlife Refuge on the Lower Colorado River is working in partnership with the *Alto Golfo de California y Delta del Rio Colorado Alto Golfo* Biosphere Reserves to protect the northern waters of the Sea of Cortez and the delta of the Colorado River, and this region is often referred to as the "wet desert" region of the Sonoran desert. Together, these adjacent areas in the "wet desert" region and the other adjacent protected areas in the "dry desert" region (the Cabeza Prieta NWR, ORPI, and *El Pinacate*) form the core areas for cross-border conservation efforts in the Western Sonoran Desert (see map two at the end of this article). These efforts are discussed in greater detail in the section on Binational Efforts in the Western Sonoran Desert, infra.[6]

Sky Islands in the Border Region

In addition to the four Mexican PNAs in the Western Sonoran and Chihuahuan Deserts, the Mexican border region includes *Sierra de San Pedro Martir* in Baja California Norte and the *Los Ajos-Bavispe* National Forest Reserve in Sonora. These areas share similar "sky island" features with two PNAs across the border in Arizona, the Chiricahua National Monument and the Coronado National Forest. Sky islands are small but steep mountain ranges separated by arid expanses of desert and grassland. "[T]hey stand above the surrounding plains much as an oceanic island rises from the sea."[7] The climate of the sky islands is cool and wet and the biotic community is different than that found at the base of the range. Since there are many miles of desert or grassland between sky islands, most animals

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6. There are other protected natural areas on the Southern California border with Mexico—the Tijuana River Slough National Wildlife Refuge and Cleveland National Forest. They will not be discussed in this article since they do not have active partnerships with conservation units in Mexico.

7. JANICE EMILY BOWERS, CHIRICAHUA 14 (1988).

remain on one island for their entire life. These sky island ecosystems add yet another unique feature to the mosaic of natural systems of the border region.

MAJOR ISSUES AFFECTING THE BORDER ECOLOGY

Deserts are injured easily and do not recover very fast, and this is certainly evident in the U.S.–Mexico border region. The desert of the border region is considered fragile because small disturbances or changes can have significant consequences on plant and animal life. For example, a single tire track over the desert floor can last for hundreds of years. The Butterfield Stage Line that brought pioneers to the western United States is still visible in many places. Even figures made in the desert by people 500 or more years ago—called intaglios—are still visible.

Population Growth and Increased Economic Activity

The last 50 years have seen a dramatic growth in the border region's population. Approximately one million people lived in the area in 1950; that number jumped to over seven million in 1990.[8] Today, the population is greater than 12.3 million and is growing twice as fast as the rest of the United States.[9] Between 1990 and 2000, the population on the U.S. side of the border grew by 23.5 percent and in Mexico the population grew by 44.6 percent.[10] This growth is due in part to the economic opportunities brought about by NAFTA. As trade and commerce increases and automobile and truck traffic grows, there is greater demand for bridges, border crossings, highways, and paved roads in the border region. Without proper planning, new infrastructure can cut through sensitive ecosystems and fragment or destroy natural habitats.

Water Scarcity

The region's natural systems, which are supported by the scarce surface water and groundwater of the desert region, have to compete with the water supply needs of a growing population. The border area has an

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8. *See* Roberto Sanchez, *Public Participation and the IBWC: Challenges and Options*, 33 NAT. RESOURCES J. 283, 286 (1993).

9. *See* PRESIDENT'S INTERAGENCY TASKFORCE ON THE ECONOMIC DEVELOPMENT OF THE SOUTHWEST BORDER, INTERIM REPORT 7 (1999).

10. *See* James Peach & James Williams, *Population and Economic Dynamics on the U.S.–Mexico Border: Past, Present and Future*, *in* THE U.S.–MEXICAN BORDER ENVIRONMENT: A ROADMAP TO A SUSTAINABLE 2020, at 37, 61-62 (Paul Ganster ed., Southwest Center for Environmental Research and Policy Monograph Series No. 1, 2000).

arid to sub-arid climate that receives 10–23 inches of precipitation per year, and historically the plant and animal life adapted to this climate. However, as the population has grown in the region, the two major drainages—the Rio Grande and the Colorado Rivers—have been overallocated, and the smaller drainages—the Tijuana, New, Alamo, Gila, El Diablo, Rio Salado, and the Rio San Juan Rivers—do not always flow year-round. The major groundwater basins that comprise an important source of the water supply include the San Pedro, the Mesilla, and the Hueco aquifers. Most of the groundwater basins that cross the border are being depleted faster than their rate of recharge.

Water pollution is one of the principal environmental and public health problems facing the border area.[11] With diminishing water supply, the problem of water quality becomes more acute. The development of wastewater treatment infrastructure has not kept pace with rapid population growth, and the result is that many border communities do not have access to clean drinking water. In many communities, raw sewage or insufficiently treated wastewater is discharged into drinking water sources. The lack of clean drinking water in the border region is causing public health problems, and the health of the fragile desert ecosystems is suffering as well. This same water that is necessary to sustain the growing human population is critical for maintaining healthy ecosystems and the amazing abundance and diversity of wildlife.[12]

The United States and Mexico allocate the use of surface waters through the 1906 Rio Grande treaty,[13] the 1944 water treaty,[14] and amendments to those treaties referred to as "Minutes." The treaties are administered by the International Boundary and Water Commission (IBWC), which is working with other government agencies and interested partners to investigate and develop management strategies to obtain clean and sustainable ground and surface water supplies.

Jurisdictional Barriers

The border ecosystems are fragmented by the growth of urban centers and roads. Along the international boundary, the partitioning of stewardship for the natural areas and PNAs fragment the management of these areas. In the United States alone there are over one dozen federal agencies that exercise jurisdiction over the conservation, use, and quality of

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11. *See* ENVTL. PROTECTION AGENCY, *supra* note 1, at III.14.

12. *See id.*

13. Convention between the United States and Mexico on Equitable Distribution of the Waters of the Rio Grande, May 21, 1906, U.S.-Mex., 34 Stat. 2935.

14. Treaty Regarding the Utilization of Waters of Colorado and Tijuana Rivers and of the Rio Grande, Feb. 3, 1944, U.S.-Mex., 59 Stat. 1219.

soil, water, mineral, timber, grassland, fish, and wildlife resources. States and Native American tribes often have functions parallel to the responsibilities of federal agencies. One reason for the division of jurisdictional authorities is that public lands in the United States have different land-use objectives. Natural resource extraction is permitted on some public lands while other land is set aside for conservation.

Drawing political and jurisdictional boundaries through natural systems becomes problematic when trying to manage the system as a whole. In *Fragmentation of Natural Resource Management in the Sonoran Desert*, Steve Cornelius observes,

> If political and jurisdictional boundaries had mimicked watersheds, elevation lines, or another natural demarcation, this diffusion of authority would be a conservation issue of far lesser consequence. Instead, national forests and grasslands, wildlife refuges, parks and monuments, military reservations, scenic rivers, and other public lands are inevitably identified on maps by very straight lines that show little if any allegiance to ecosystem boundaries. The significance of this is that management of our natural resource base has been inconsistent and often scientifically flawed.[15]

The problem of fragmentation is even greater when the ecological region is divided by an international boundary, especially when the international boundary is between two nations at different levels of economic development. See table 1 for a description of the jurisdictional boundaries in the transborder ecological regions.

In Mexico, the Secretariat of the Environment, Natural Resources, and Fisheries (SEMARNAP) is the main central authority for natural resources management. The Mexican government owns very little land; many of the federally designated PNAs are drawn around community land called *ejidos* and allow some level of natural resource extraction. Some state ecology agencies are more active than others in the border region. In Sonora, for example, the Institute for Environment, Natural Resources, and Sustainable Development (IMADES) manages PNAs jointly with SEMARNAP.

Overcoming the challenge of fragmented jurisdictional authority and different land use objectives is not an easy task, but it is not impossible either. One factor that is required is a commitment among the land managers to coordinate with their cross-border counterpart land managers

15. Steve Cornelius, Fragmentation of Natural Resource Management in the Sonoran Desert 5 (Feb.1998) (unpublished manuscript, on file at the Sonoran Institute, Tucson, Ariz.).

on decisions and actions that affect the ecological region—or ecoregion[16]—as a whole. Land managers in the border region are becoming more enthusiastic about transborder cooperation because they understand that their management decisions and actions can be more effective if coordinated with actions on adjacent lands.

When NAFTA was signed, the U.S. and Mexican governments began to focus a great deal of attention on environmental conditions on the border. This led to the creation of high-profile programs such as the U.S.-Mexico Border XXI, and binational environmental institutions such as the Border Environmental Cooperation Commission and the North American Development Bank. The increased attention to border environmental issues on the part of the two governments has meant that agencies have increased funding and staff to carry out cooperative projects, which has in turn made it easier for local land managers to engage in cross-border collaboration.

Illegal Immigration and Narcotics Smuggling

One of the common challenges for all border PNAs—especially those on the U.S. side of the border—is the increase in traffic of narcotics and undocumented immigrants. The U.S. government is attempting to curb this illegal activity through initiatives such as Operation Gatekeeper in southern California and Operation Rio Grande in southern Texas. Unfortunately, as the entry points around the urban areas become more impassable, this illegal activity is funneled through the rural, desert areas in the border region. The dual effect is that more human lives are endangered because of the hazards of crossing an open desert, and the foot and vehicle traffic degrades the ecological health of the desert.

The rugged and isolated Otay Mountain in southern California, managed by BLM, provides a good example of this problem. What was once a vast, contiguous, undeveloped landscape is now a major thoroughfare for undocumented immigrants traveling on foot. Otay's harsh terrain and scarcity of water and shelter have created a public safety crisis. Many campfires spread out of control and turn into wildland fires due, in part, to the current drought conditions. Further, immigrant foot traffic carves hundreds of trails throughout Otay Mountain and generates large

16. There has been a push by non-governmental organizations to move beyond single-species and habitat conservation to large-scale ecology conservation. World Wildlife Fund (WWF) defines ecoregions as "a relatively large unit of land or water that is characterized by distinctive climate, ecological features, and plant and animal communities." WORLD WILDLIFE FUND, THE GLOBAL 2000: A BLUEPRINT FOR SAVING LIFE ON EARTH (1998). The Chihuahuan Desert is just one example of the 200 ecoregions that WWF has identified in its Global 200 initiative.

amounts of trash; plastic water containers are the most prevalent debris.[17] In response, BLM is working with the U.S. Border Patrol and the California Department of Forestry and Fire Protection to deal with emergency situations. The agencies are erecting "danger" signs and wildfire prevention warnings in Spanish and English. Additionally, several four-wheel drive roads, a foot/horse trail, and small helispots are being installed to give government officials better access to the area. While these measures are helpful in dealing with the environmental damage and public safety crisis, the problems have not gone away.

The U.S. Customs Service (USCS) has also been trying to make the border less "porous" by closing off unofficial entry points through the miles of open border country. There are several places along the Rio Grande where the water is so low that people can simply walk across the riverbed to the other side.

At Big Bend National Park, there are a number of crossings between the Park and a few villages in Mexico. In 1998, these crossings were not designated as official points of entry, so the USCS notified Big Bend National Park that the crossings were in violation of a federal law that states that "individuals...shall enter the United States only at border crossing point designated by the Secretary [of USCS]...and present themselves, and all articles accompanying them for inspection to the customs officer at the customs facility designated for that crossing point."[18]

Officials at Big Bend National Park did not want to be in violation of federal law, but they did not want to close the crossings either. The crossings led to three small Mexican villages that serve as gateways to recently declared PNAs: the Maderas del Carmen and Santa Elena Canyon Flora and Fauna Protected Areas. At the crossing, a rowboat operator charged $1.00 to take people to the other side of the river.

The crossings within Big Bend are used for many purposes and are critical to some of the Park's functions. Park personnel access the crossings to work with ranchers in the Mexican villages to prevent livestock trespass, conduct environmental education programs for school children, carry out cooperative law enforcement investigations, and attend village meetings and public briefings. The residents of the Mexican villages use the crossings to access Big Bend National Park for necessities including food, public telephones, and postal services. The closest Mexican towns where such goods and services could be otherwise purchased are roughly four hours away. In addition, the Park's tourists visit the villages to experience a bit of

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17. *See* CAL. DESERT DIST. OF THE BUREAU OF LAND MANAGEMENT, U.S. DEP'T OF THE INTERIOR, PUB. NO. CA-063-06-000, OTAY MOUNTAIN BORDER ACCESS ROAD AND TRAILS PROJECT: ENVIRONMENTAL ASSESSMENT 2 (1996).

18. 19 U.S.C. § 1459 (1994).

Mexico and access the new PNAs. Without these tourist dollars, the villagers would be more likely to revert to raising livestock, which could further increase natural resource degradation.

Travel between the Park and the villages across the river takes about one half hour. Without the Big Bend crossings, the trip from the Mexican villages back to the Park through Presidio, the closest port of entry, takes one to two days, since access is on dirt roads that weave through mountainous terrain.

When top officials at USCS learned more about the situation, they were sympathetic to the Park's needs and forged an agreement with the NPS. UCSC did not have the financial resources to staff the Big Bend crossings, but wanted to ensure some form of oversight. So, NPS staff at Big Bend National Park were trained and authorized to administer customs functions for people using the crossings. This proved to be a win-win situation.

Efforts by the U.S. Immigration and Naturalization Service (INS) and U.S. Border Patrol to stem the flow of illegal immigration and narcotics can inadvertently inflict environmental damage on the border region. Under its Operation Rio Grande, INS plans to rebuild roads, burn vegetation, and construct fences, lighting systems, and boat ramps along roughly 100 miles of land adjacent to the Rio Grande. Environmental NGOs are suing the federal government over Operation Rio Grande. In their suit, Defenders of Wildlife, the Sierra Club and the Frontera Audubon Society allege that Operation Rio Grande will ruin some of the last remaining habitat for ocelots and jaguarundis—two endangered cat species.[19]

Federal environmental agencies such as DOI and the Environmental Protection Agency (EPA) often find themselves caught somewhere in the middle between the NGOs' environmental concerns and the INS's law enforcement mission. DOI and EPA are consulting with INS as that agency conducts an environmental impact assessment of its border operations to determine the best alternatives with the least environmental impact. This assessment is underway despite language in the 1996 Immigration Act[20] that waived all legal obligations for INS to comply with the environmental requirements of the Endangered Species Act (ESA)[21] and the National Environmental Policy Act (NEPA).[22]

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19. *See* Defenders of Wildlife, Operation Rio Grande Too Dangerous: Defenders Threaten to Sue to Protect Endangered Ocelot, Jaguarundi (March 15, 1999) (unpublished press release, on file with author).

20. Illegal Immigration Reform and Immigrant Responsibility Act of 1996, Pub. L. No. 104-208, div. C, §§ 101-671, 110 Stat. 3009, 3009-546 to 3009-724.

21. 16 U.S.C. §§ 1531-1544 (1994).

22. 42 U.S.C. §§ 4321- 4370 (1994).

The Immigration Act waived compliance with the ESA and NEPA "to the extent the Attorney General determines necessary to ensure expeditious construction of roads and barriers at the border."[23] Attorney General Janet Reno, Secretary of the Interior Bruce Babbitt, and Chair of the Council on Environmental Quality Kathleen McGinty sent a letter to then-Speaker of the House Newt Gingrich requesting that Congress delete this waiver.[24] That effort, however, failed and the waiver stayed in the bill. President Clinton expressed concerns about the waiver when he signed the bill into law.[25] Although no federal agency, including INS, has opted to use the waiver, it is a constant reminder of the obstacles facing conservation efforts in the border region.

One lesson learned is that when government actions on the border are taken in isolation from one another, there are bound to be unforeseen negative results. This logic applies not only to NPS and UCSC—federal agencies with somewhat conflicting missions for the border—but to agencies with similar goals, such as those involved in land management. There are numerous reasons why the use of public lands as major illegal immigration and drug corridors will continue to increase. Expanded security around legal ports of entry will funnel illegal activities through public lands, which provide vast, open uninhabited areas with limited law enforcement presence. These lands lie adjacent or close to hundreds of air strips and stash houses located just south of the border, where the topography allows for the establishment of clandestine air strips.[26] At this time, the best that DOI land management agencies can do is try to work with INS so that the most sensitive wildlife habitat is not disturbed while INS conducts its operations. For the U.S. public land manager on the border, dealing with these problems while simultaneously attempting to forge conservation connections with Mexican counterparts can be awkward.

POLITICAL AND ECONOMIC FACTORS

While there are efforts underway to make the border less porous and stem criminal activity, political influences are promoting more cross-border cooperation. Presidents Clinton and Zedillo endorsed this concept

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23. Illegal Immigration Reform and Immigrant Responsibility Act of 1996, Pub. L. No. 104-208 at § 102(c), 110 Stat. at 3009-555 (codified at 8 U.S.C. § 1103(note) (Supp. III 1997)).

24. *See* Letter from Janet Reno, Attorney General, Bruce Babbitt, Secretary of the Interior & Kathleen McGinty, Chair, Council on Environmental Quality, to Newt Gingrich, Speaker of the House (Sept. 16, 1996) (on file with author at Department of the Interior).

25. *See* Statement on Signing the Omnibus Consolidated Appropriations Act, 1996 PUB. PAPERS 1729, 1731-32 (Sept. 30, 1996).

26. *See generally* U.S. DEP'T OF THE INTERIOR, SOUTHWEST BORDER LAW ENFORCEMENT COUNTERDRUG STRATEGY (1998).

in a Joint Statement on Migration, signed May 6, 1997.[27] The statement calls for "new integrated approaches to mutually beneficial economic, social, environmental, and cultural development in border communities;...public and private partnerships in developing cross-border interests and activities,...and new approaches to managing temporary travel between border communities, consistent with the laws of each nation, recognizing the economic, social, and family benefits of vigorous cross border exchange."[28] One of the guiding principles of the declaration is "dedication to a comprehensive vision of managing migration and our shared border that turns differences between our nations into sources of strength, and that leads to mutually-beneficial economic and social development that preserves family reunification and protects human dignity."[29] The Statement recognizes the rich social and cultural mix of the border region and puts a human face on issues on both sides of the border.

Joint declarations and statements signed by top-level policy makers can go a long way toward improving the binational relationship in the border region. DOI Secretary Babbitt and SEMARNAP Secretary Carabias signed a Letter of Intent to Enhance Collaboration in Adjacent Protected Natural Areas on the U.S.–Mexico Border on May 6, 1997[30] at the same annual meeting of the governments where the Presidential Joint Statement was issued. The Letter of Intent has become a key mechanism for transboundary natural resource management because local land managers are empowered to work with their counterparts in adjacent PNAs across the border without having to go through their national capitals for permission. Although cross-border cooperation certainly existed prior to 1997, it is now happening more frequently and on a larger scale.

It is important to note that Mexico has only begun to fully develop a PNA system with staffing and funding in the past eight years. In 1992, the World Bank's Global Environmental Facility (GEF) awarded a $25 million grant to the Mexican government to provide long-term support for biodiversity conservation in Mexico. The Mexico Nature Conservation Fund, a private non-profit organization, was created with the GEF grant and an additional Mexican government contribution of $10 million. This channeled the funding into an endowment for long-term support of conservation of Mexico's natural resources, including ten top priority

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27. Joint Statement on Migration Adopted by the President of the United States and the President of Mexico, 33 WEEKLY COMP. PRES. DOC. 662 (May 6, 1997).

28. *Id.*

29. *Id.*

30. Letter of Intent between The Department of Interior of the United States and the Secretariat of Environment, Natural Resources and Fisheries of the United Mexican States for Joint Work in Natural Protected Areas on the United States–Mexico Border, May 6, 1997, U.S.–Mex. (on file with author) [hereinafter Letter of Intent].

PNAs. In addition, the Mexican government has recently provided funding for several other reserves including the four PNAs in the border region that are part of the DOI-SEMARNAP Letter of Intent.

Economic disparity between the two countries is still an underlying factor influencing conservation efforts on the border. Even though most of the Mexican PNAs on the border have management plans, basic infrastructure, and equipment, they typically will only have five to ten staff members, compared to about 100 staff members in a similarly sized PNA in the United States. The Mexican government staff do not have the same job security as their U.S. counterparts, which becomes more of an issue at the beginning of a new sexenio.[31] There is no civil service in Mexico like in the United States. In the past, most government employees resigned when a new President began his term, even when the President was from the same political party. However, SEMARNAP has been trying to strengthen the government's environmental legal regime so that employees in the field will be able to keep their jobs with a change in government leadership.

This difference between the economic and political systems of the United States and Mexico does not imply, however, that the cross-border relationship is one-sided. While the Mexican PNAs are receiving technical assistance and training from the United States on development of natural resource programs, the U.S. PNAs are learning from their Mexican counterparts how to work better with the surrounding communities on *sustainable use* of natural resources. Out of necessity, Mexico is capable of *doing more with less*—an important lesson for the U.S. PNAs.

BINATIONAL EFFORTS IN THE WESTERN SONORAN DESERT

The Babbitt/Carabias Letter of Intent[32] identified two pilot areas—the Western Sonoran Desert and the Big Bend area of the Chihuahuan Desert. The adjacent protected areas of the Western Sonoran Desert pilot area in the United States include the Organ Pipe Cactus National Monument, Cabeza Prieta National Wildlife Refuge, Imperial National Wildlife Refuge, and in Mexico, *El Pinacate* and the *Alto Golfo* Reserves. President Salinas de Gortari decreed these Mexican Biosphere Reserves on June 10, 1993.

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31. Sexenio refers to the six-year term of the President of Mexico. Mexico's history of single-party rule is coming to an end on December 1, 2000, when the *Partido Acion Nacional* (PAN) takes over the presidency. The *Partido Revolucionario Institutional* (PRI) has been in power since 1929.

32. Letter of Intent, *supra* note 30.

Biodiversity in the Western Sonoran Desert

The Sonoran Desert is a hot, semitropical desert and is home to the largest and most intact display of desert and xeric shrublands on the continent.[33] It covers approximately 100,000 square miles (260,000 sq. km.) and includes the southern half of Arizona, southeastern California, most of the Baja California peninsula, the islands in the Gulf of California, and a large portion of the state of Sonora. The indicator species of the desert—the Saguaro Cactus—is one of over 30 species of cacti found in the Sonoran Desert. The creosote bush dominates the inter-mountain valleys, with mesquite and blue palo verde trees found in the riparian areas. Approximately 600 flora types have been identified in Organ Pipe Cactus National Monument alone. Some of the endangered species in the Sonoran Desert include the lesser long-nosed bat, the Sonoran pronghorn, the peregrine falcon, the brown pelican, the cactus ferruginous pygmy-owl, the Aplomado falcon, the jaguarundi, and the Quitobaquito desert pupfish.[34]

The Lower Colorado River is the major source of water for the Sonoran Desert. The river was once a wild desert river flowing into Mexico that sustained riparian woodlands, freshwater wetlands, and tidal marshes. The river was once lined with cottonwood and willow forests, sustained by periodic flooding. However, today the Colorado River is one of the most heavily dammed and diverted rivers in the United States, greatly altering natural ecosystems along the way. A large number of species that depend on these ecosystems—for example, the southwestern willow flycatcher and the Yuma clapper rail—are now endangered in the United States. Even in its current condition, however, the Colorado River remains a key part of the border region ecosystem.

Conservation Efforts

The last decade has seen a tremendous amount of interest and energy directed toward the protection of the Western Sonoran Desert. On October 7-8, 1997, the first implementation meeting for the Western Sonoran Desert pilot area identified in the Letter of Intent was held in Puerto Peñasco. The second major meeting was held in Tucson on July 27-28, 1999. Each meeting brought together approximately 100 people from federal and state governments, NGOs, and Native American tribes—evidence of the huge amount of interest in Western Sonoran Desert conservation. In

33. *See* Cornelius, *supra* note 15, at 6.

34. *See* GINA PEARSON, DEP'T OF THE INTERIOR, ORGAN PIPE NATIONAL MONUMENT: TRI-NATIONAL MANAGEMENT CHALLENGES AND OPPORTUNITIES FOR COOPERATION WITH MEXICO AND THE TOHONO O'ODHAM NATION 3 (1998).

between the major meetings, local land managers now meet on a regular basis to provide continuity and keep the work going. The next few sections of this article describe some of the joint projects of these land managers and NGOs.

Ecotourism and Public Outreach in the Western Sonoran Desert

The adjacent PNAs and some local NGOs are working together to enhance visitor use and educate the public about the need to protect the Western Sonoran Desert. Together, they hope to foster local-level support for the protection of natural resources by encouraging voluntary participation in the area's protection. Since the signing of the 1997 Letter of Intent, the following activities have occurred:

- The staff of the U.S. Imperial National Wildlife Refuge assisted Mexico's *Alto Golfo* Biosphere Reserve staff and volunteers from the Ejido Johnson in erecting a wildlife viewing tower in the Cienega de Santa Clara, an important wetland in the Colorado River delta.

- Reserve staff from the United States and Mexico are working together to train residents from the local *ejidos* to become park rangers. Once trained, these new rangers will be responsible for enforcement, waterfowl management, and moist soil management.

- La Ruta de Sonora Ecotourism Association was legally established as a non-profit organization to encourage sustainable visitor use of protected natural areas, provide benefits to local communities adjacent to the protected areas, and direct funding to conservation priorities.

- A bilingual brochure, poster, and fact sheet on Sonoran Desert ecology and conservation in the adjacent protected natural areas has been produced for distribution throughout the region.

- Binational public education displays were erected at the Yuma County Fair and the Yuma International Airport in Arizona.

- A Spanish-language "Leave-No-Trace" wilderness video was provided to the *El Pinacate* and *Alto Golfo* Biosphere

Reserves by Organ Pipe Cactus National Monument for use in environmental outreach and education activities.

- An educational video was produced on the Lower Colorado River ecosystem that includes information about cooperation between U.S. and Mexican reserves.

Riparian and Desert Restoration in the Western Sonoran Desert

PNA land managers in the Western Sonoran Desert are carrying out technical exchange and training on restoration techniques and practices. In the Colorado River subdivision of the Western Sonoran (the wet desert), the staff of the Imperial National Wildlife Refuge (NWR) and the *Alto Golfo* Biosphere Reserve conducted a riparian restoration pilot project in the El Doctor wetlands of the Lower Colorado River delta in Mexico. Another restoration project was conducted in the Martinez Marsh wetlands at the Imperial NWR. These sister reserves will jointly complete one binational riparian or wetland restoration project each year, alternating between countries. Imperial NWR has donated water quality monitoring equipment to the *Alto Golfo* Biosphere Reserve to assist in monitoring wetland water quality in the Cienega de Santa Clara and identify potential restoration sites.

Organ Pipe Cactus National Monument designed a desert restoration project to share successful (and unsuccessful) techniques in disturbed desert sites in the protected natural areas. This project includes workshops, field trips, and hands-on restoration work. The emphasis is on low-tech methods that rely on volunteer help and minimal funding to produce positive restoration results.

Evaluation of Wildlife Problems

Wildlife conservation has been a common priority for cooperation between the United States and Mexico since the passage of the 1936 U.S.–Mexico Migratory Bird Treaty.[35] That treaty, which required the conservation of migratory game birds, has since been expanded to include all types of waterfowl, shorebirds, and migratory birds.

In the Western Sonoran Desert, the Sonoran pronghorn and the bighorn sheep are the two animals that first drew scientists

35. Convention for the Protection of Migratory Birds and Game Mammals, Feb. 7, 1936, U.S.–Mex., 50 Stat. 1311.

together in cross-border cooperation. Today, in addition to those large mammals, natural resource managers and scientists are collaborating on other endangered species such as the desert pupfish, the Yuma clapper rail, and the southwestern willow flycatcher. Approximately 75 percent of the species listed as threatened, endangered, and candidate species in Arizona also reside in Sonora.[36]

The Arizona Game and Fish Department and IMADES, the Sonoran state ecology agency, began working together in the early 1980s and now have a long list of joint species projects. In addition to the species listed above, the agencies also work together to protect the Gould turkey, masked bobwhite quail, desert tortoise, native fishes, Mexican spotted owl, Mexican wolf, thick-billed parrot, maroon-fronted parrot, and Sonoran breeding birds. Their work consists of surveys, monitoring activities, and reintroductions within the species' historic ranges. Due to their extensive conservation work, the Arizona and Sonora state agencies are key to the implementation of the Babbitt/Carabias Letter of Intent, and many of their projects are now being carried out in partnership with the federal agencies. The two projects described below elaborate on the species conservation efforts underway in the Western Sonoran Desert.

The Yuma Clapper Rail Project of the Colorado River Delta

Federal and state scientists and local university researchers are working together in the Colorado River delta to determine the condition, distribution, and habitat of the Yuma clapper rail. A large amount of the bird's habitat has been lost due to construction of channels and other water development projects on the Lower Colorado River. The few wetlands in the delta—such as the Cienega de Santa Clara, the Hardy River, and the El Doctor wetlands—are among the last remaining areas to provide habitat for the many threatened or endangered species of birds and fish. The objectives of the project are to (1) determine the presence and abundance of the Yuma clapper rail, (2) determine the demographic characteristics of the population (e.g., reproduction, survivability, mortality rate), (3) describe the habitat used by the Yuma clapper rail on a micro- and

36. *See* Francisco J. Abarca et al., Conservation Opportunities in the Borderlands: The Arizona-Sonora Perspective 3 (Sept. 19, 1994) (unpublished paper presented at the Symposium on Biodiversity and Management of the Madrean Archipelago in Tucson, Ariz., Sept. 19-23, 1994, on file with author).

macro-habitat scale, and (4) detect possible selenium contamination in Yuma clapper rail eggs.[37]

Recovery and Conservation of Sonoran Pronghorn

What was likely a single population of Sonoran pronghorn that ranged across the Arizona-Sonora border is now divided by roads and highways. The probable expansion of Highway 2—an east-west highway on Sonora's northern border with Arizona—will make the terrain even more impassable for wildlife. A binational recovery team is trying to establish and maintain separate and viable populations of Sonoran pronghorn in both Sonora and Arizona, preferably in historic habitats. To increase genetic diversity among the divided population, individual pronghorns in Mexico will be exchanged with those in the United States. The scientists are identifying and defining quality Sonoran pronghorn habitat conditions using land, air, and satellite photography. Twice in 1999, the binational recovery team conducted reconnaissance flights and aerial surveys in Sonora in search of Sonoran pronghorns.[38]

Geographic Information System Development in the Western Sonoran Desert

Researchers from Organ Pipe Cactus National Monument (ORPI) and *El Pinacate* are working on seamless digital maps to improve the management of natural resources in the Western Sonoran.[39] They are developing a Geographic Information System (GIS)[40] that cuts across jurisdictional boundaries and covers the areas of concern. In addition, BLM is training Mexican government personnel to work with GIS in *El Pinacate* and *Alto Golfo* Biosphere Reserves.

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37. For more information, contact Charlie Sanchez Jr., U.S. Fish and Wildlife Service Region 2, 500 Gold Avenue, SW, Room 3018, Albuquerque, New Mexico, 87103-1306.

38. For more information, contact Don Tiller, Refuge Manager, Cabeza Prieta National Wildlife Refuge, Arizona, at (520)-387-6483.

39. For more information, contact Bill Wellman, Superintendent, Organ Pipe Cactus National Monument, Arizona.

40. Geographic Information Systems (GIS) technology can be used for development planning, natural resource management, environmental analysis and scientific investigations. A GIS is a computer system capable of assembling, storing, manipulating and displaying geographically referenced information—data identified according to their locations. For example, a GIS might be used to relate information about rainfall in a state to aerial photographs of a county in that state in order to determine which wetlands in the county dry up at certain times of year.

The researchers' goals include acquisition and installation of GIS plotter equipment in *El Pinacate,* improvement of the database of resources, and development of regional maps of the Western Sonoran Desert. The pilot project for the GIS group will be a basic digital map indicating the locations of the endangered desert pupfish. The U.S. Geological Survey (USGS) will provide digital raster graphics—scanned images of USGS topographic maps—to *El Pinacate* and ORPI to establish a background layer of digital data for applications.[41]

Monitoring of Ecosystem Health

Monitoring an ecosystem over a long period of time is the only way to learn whether conservation projects are working. Systematic, consistent, and periodic collections of specific information make it easier to understand trends and conditions of a particular landscape. Unfortunately, monitoring activities are usually the first to get cut during budget shortfalls. In the Western Sonoran Desert, land managers and environmental NGOs such as the Sonoran Institute have made ecosystem monitoring a greater priority. This is due to political mandates and increased interest in both countries in measuring the results of conservation activities to defend decisions and investments. The problem often faced in taking ecosystem health measures on a landscape scale is that there has never been one set of standards among scientists for gathering data and conducting research. As isolated research, the data is interesting but impossible to compare with other data over time.

ORPI has ten years of experience in natural systems monitoring and will lead the efforts among the protected areas in their region. If funding can be obtained, ORPI will conduct a series of training events over the next few years, and the adjacent PNAs will choose a few indicators of environmental change and health to conduct baseline measures. Land managers and partner NGOs have identified the most effective indicators (environmental components) of ecological changes and health as (1) birds (with emphasis on neotropical migrants), (2) climate, (3) lizards, (4) small nocturnal rodents, (5) vegetation cover, (6) visibility (air quality), and (7) well monitoring (i.e., simple depth to groundwater). The long-term

41. U.S. Geological Survey and its counterpart agency in Mexico, INEGI, are working together on a binational aerial photography and mapping initiative designed to counteract "White Map" syndrome—U.S. maps are frequently blank (or "white") south of the border, and Mexican maps are often "white" north of the border.

objective is to develop a permanent, binational, multicultural system for effective and inexpensive monitoring and create a "data-rich and objective report card on the health of Sonoran Desert."[42]

BINATIONAL EFFORTS IN BIG BEND COUNTRY

In addition to the Western Sonoran Desert, five protected areas in the Big Bend region of the Chihuahuan Desert are also serving as a pilot project under the Babbitt/Carabias Letter of Intent.[43] The Chihuahuan Desert—nearly a quarter-million square miles—is thought to be one of the most biologically rich and diverse desert ecoregions in the world. The World Wildlife Fund ranks it among the top ten ecoregions in North America for species that exist nowhere else on Earth. The Chihuahuan Desert supports 1,500 of the world's 3,250 known species of cacti. The Desert is also home to over 250 species of butterflies, including North America's largest butterfly, the giant swallowtail. It hosts the largest remaining prairie dog towns in the world; large mammals such as the pronghorn, javelina, Mexican gray wolf, jaguar, and black bear roam the area. Raptors such as zone-tailed hawks, peregrine falcons, and golden eagles share the skies of this binational region. Grasslands, desert shrub, riparian corridors, and high elevation mountains ranges can all be found in the Chihuahuan Desert.

The five adjacent PNAs—Big Bend National Park, Big Bend State Ranch, and Blackwater Gap Wildlife Management Area in the United States, and Mexico's Maderas del Carmen and Santa Elena Canyon FFPAs—form a corridor containing some of the highest diversity of plants and animals in the desert, including amphibians, reptiles, insects, and birds. The Rio Grande forms the international boundary, and its aquatic environment and associated riparian vegetation add to the biodiversity of the corridor.

In 1944, President Franklin D. Roosevelt and President Manuel Avila Camacho corresponded about the notion of establishing a binational Peace Park in the Big Bend area. On October 24, 1944, President Roosevelt wrote a letter to President Camacho stating, "I do not believe that this undertaking in the Big Bend [referring to the establishment of Big Bend National Park] will be complete until the entire park area in this region on both sides of the

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42. Sonoran Institute, Monitoring Ecosystem Health of the Sonoran Desert, (Mar. 16, 2000) (unpublished manuscript, on file with author).

43. Letter of Intent, *supra* note 30.

Rio Grande forms one great international park."[44] President Camacho responded to President Roosevelt's letter by stating that he agreed with Roosevelt and had instructed Mexico's Department of Foreign Relations to pursue studies that would lead to the creation of the Mexican section of the Park.[45] The concept never came to fruition because landowners, particularly Americans who owned or leased property in Mexico, were concerned that their property would be taken by the Mexican government without compensation.[46] However, on November 7, 1994, Mexico laid the seeds for a cross-border conservation relationship when President Zedillo declared the Maderas del Carmen and Santa Elena Canyon as Flora and Fauna Protected Areas.[47]

As of today, there is still no Peace Park designation declared by the United States and Mexico through an executive level agreement or congressional action, but cross-border collaboration has been strengthened due to the Babbitt/Carabias Letter of Intent. These protected natural areas share many common threats, so it makes imminent sense that they share solutions to those threats. The directors of these adjacent protected areas have identified several issues of mutual priority, such as invasive and exotic species, endangered species, and wildland fire management.

The Rio Grande and Natural Resources Conservation

On a trip to Big Bend National Park on April 11, 1999, Secretaries Babbitt and Carabias took a hike with the superintendent of the Park and discussed the ecological impacts of changes in quantity and quality of stream flows of the Rio Grande. Park scientists have been witnessing habitat degradation in the riparian corridor of the adjacent protected areas because less water has been reaching their area of the border. Moreover, with less streamflow to dilute the water pollution furthered by the lack of wastewater treatment facilities upstream in the Juárez area, the quality of the stream flows in the Park is worsening. That hike led to a decision between Secretaries Babbitt and Carabias and the IBWC

44. JOHN JAMESON, THE STORY OF BIG BEND NATIONAL PARK 112 (1996).

45. *Id.*

46. *See* Daniel Lou Roth, Mexican and American Policy Alternatives in the Big Bend Region–An Updated Study of the Proposed Mexican National Park in the Sierra del Carmen (1992) (unpublished M.P.A. thesis, University of Texas (Austin)) (on file at Big Bend National Park).

47. *See* INSTITUTO NACIONAL DE ECOLOGÍA, PROGRAMA DE MANEJO DEL ÁREA DE PROTECCIÓN DE FLORA Y FAUNA CAÑÓN DE SANTA ELENA, MÉXICO 7 (1997).

commissioners to hold a technical binational symposium to address the problem.[48] This initiative would not have happened without the friendship and trust that exists between Secretary Babbitt and Secretary Carabias.

Joint River Patrol of the Rio Grande/Río Bravo

Personnel from the three nationally protected areas—Big Bend National Park, Maderas del Carmen FFPA and Santa Elena Canyon FFPA—have conducted joint river patrols to provide cross-training of staffs in patrol techniques and to unify overall transboundary protected area resource management and visitor use policies. The first three-day international river patrol occurred in October 1997, and included a river seminar for private-sector tourist service providers. Since then, a regular program of joint binational patrols has been established. On the joint river patrols, park rangers discuss policies, new regulations, and binational issues for protection of natural resources.

Binational Cooperative Species Management and Research

The PNA staff from each country have identified species of concern whose populations span the international boundary and the staff are developing monitoring, research, and support programs to address species conservation. As part of this overall program,[49] they are carrying out a region-wide assessment on the status of the Peregrine falcon population in Big Bend National Park, Texas' Black Gap Wildlife Management Area, and Maderas del Carmen FFPA. Scientists are also (1) creating a baseline dataset of U.S.–Mexico black bear genetic relatedness and genetic diversity, (2) completing U.S.–Mexico protected area fish inventory and assessment, and (3) developing an understanding of population distribution and genetic status of Big Bend mosquitofish. In addition, protected area personnel are seeking funding for research and management programs to address impacts of exotic nutria invasion and to establish monitoring for the beaver, which is an endangered species in Mexico.

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48. The Rio Grande/Río Bravo: Ft. Quitman to Amistad Reservoir Symposium took place on June 14, 2000, in Ciudad Juarez. (For more information, contact author).

49. For more information, contact Frank Decker, Superintendent, Big Bend National Park, Texas.

Integrated U.S.-Mexico Wildland Fire Management

Resources management personnel have established a cross-training and mutual assistance program to address wildland fire needs on both sides of the border. Big Bend National Park, through it's Project Diablos, trains and offers on-the-job experience for firefighters from the communities within the Maderas del Carmen and Santa Elena Canyon FFPAs. Once trained, these firefighters participate in fire suppression and prescribed burns in Big Bend National Park. Since the park is in a very remote area, access to local fire fighters, even if they are across the border in Mexico, can be critical to responding rapidly to emergency situations.

CONCLUSION

The "sister reserve" relationships that DOI and SEMARNAP have formed under the leadership of Secretaries Babbitt and Carabias will serve as the foundation for future conservation efforts. Supporters of these efforts hope that the imminent change in presidential administrations elections in both countries will not disrupt the momentum that is building for conservation work.

The Mexican government has worked hard to strengthen the laws and institutions that govern the management of its protected natural areas. As a result, Mexican PNAs now have the funding to conduct conservation work and maintain consistent staffing levels. The latter is important because effective cross-border conservation efforts are largely dependent upon personal relationships between managers and researchers on each side of the border.

U.S. federal and state natural resource agencies are working harder to cooperate across jurisdictional lines. The work of both countries has created a synergy in which cross-border connections will become an increasingly larger part of the social and cultural fabric that makes the U.S.–Mexico border region so unique.

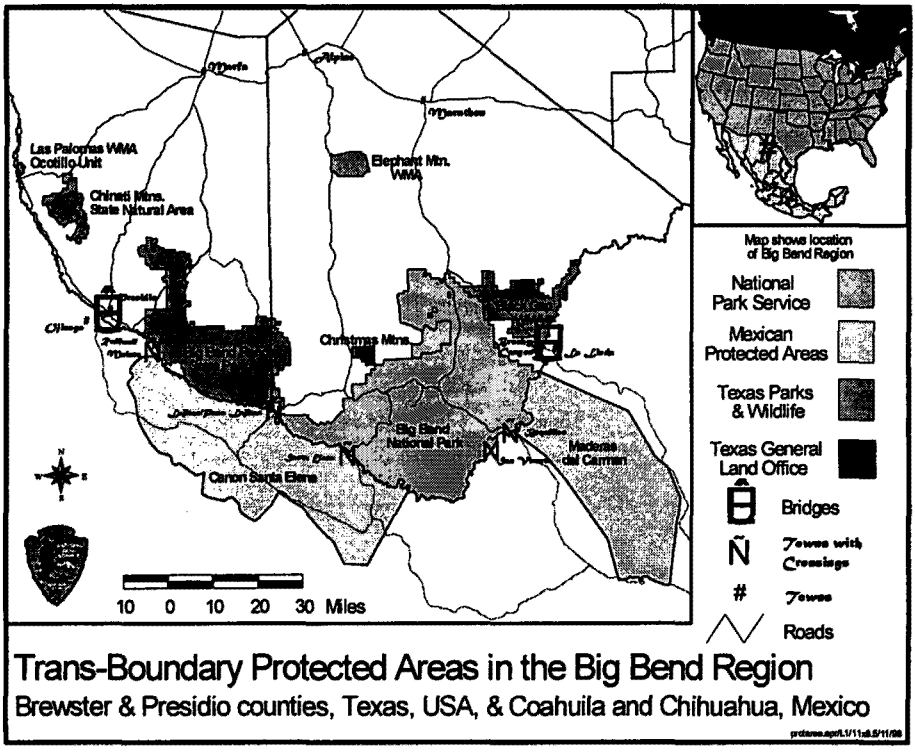
The complex dynamics of political influences in the U.S.–Mexico border region often seem at cross-purposes, and socio-economic influences in each country often place conservation efforts behind other pressing issues. However, in the face of incredible challenges and threats, the type of cross-border connections described in this article offer hope for natural resources protection in the border region.

TABLE 1: JURISDICTIONAL BOUNDARIES WITHIN TRANSBORDER ECOLOGICAL REGIONS

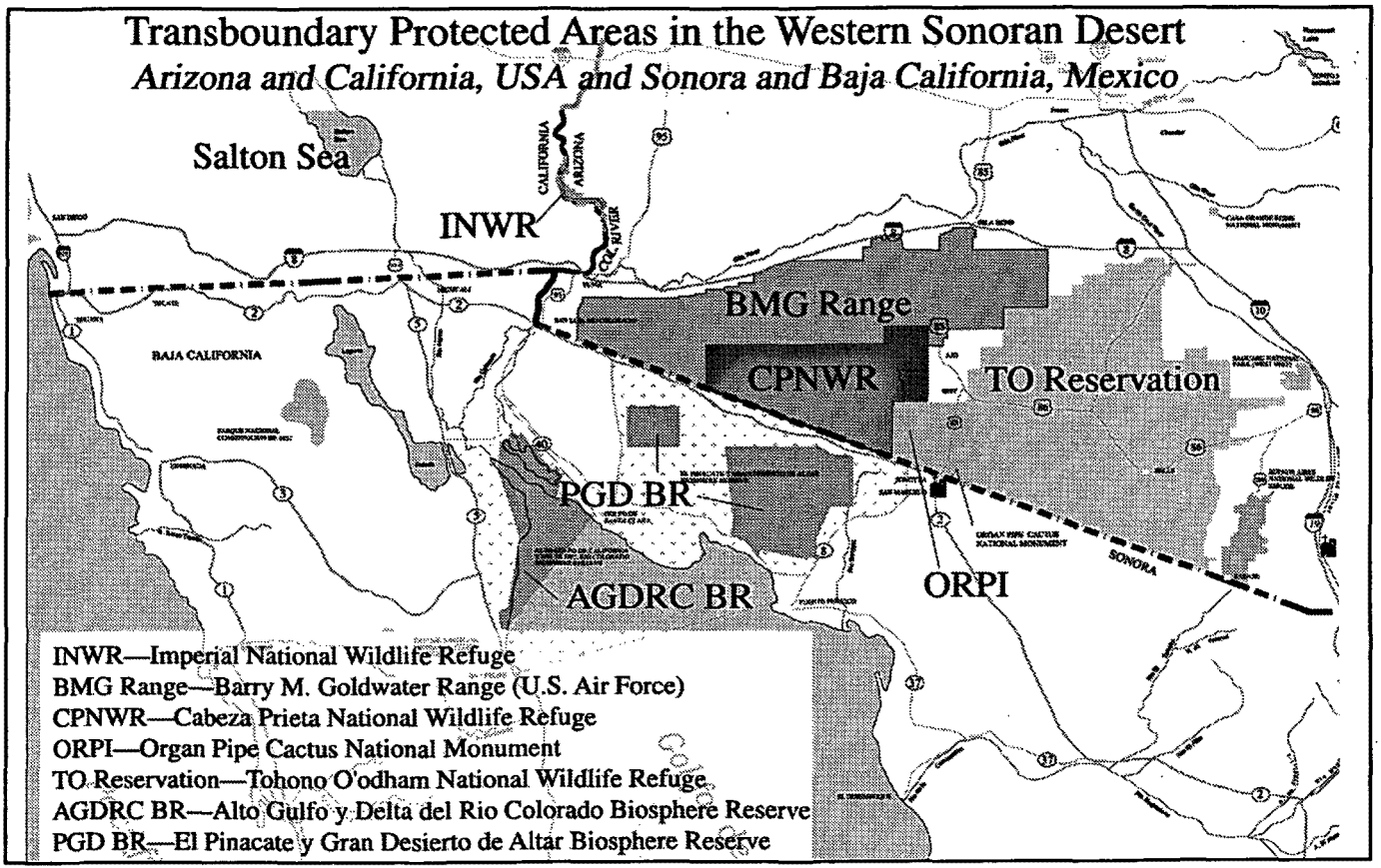
AGENCY	WESTERN SONORAN DESERT	UPPER SAN PEDRO RIVER BASIN	CHIHUAHUAN DESERT
U.S. National Park Service	Organ Pipe Cactus National Monument	El Coronado National Memorial Chiricahua National Monument (located in the Chiricahua mountain range near the San Pedro River Basin)	Big Bend National Park
U.S. Fish and Wildlife Service	Cabeza Prieta National Wildlife Refuge Imperial National Wildlife Refuge	There are no FWS administered lands, but FWS is involved in endangered species issues in the basin.	There are no FWS administered lands, but FWS is involved in endangered species issues in the region.
U.S. Bureau of Land Management	Various parcels of land administered by BLM	San Pedro National Riparian Conservation Area	--
U.S. Department of Defense	U.S. Air Force Barry M. Goldwater Range	Ft. Huachuca	--
U.S. Forest Service	--	Coronado National Forest	--

TABLE 1 (CONTINUED): JURISDICTIONAL BOUNDARIES WITHIN TRANSBORDER ECOLOGICAL REGIONS

AGENCY	WESTERN SONORAN DESERT	UPPER SAN PEDRO RIVER BASIN	CHIHUAHUAN DESERT
Texas Parks and Wildlife Department	--	--	Big Bend Ranch State Park Black Gap Wildlife Management Area
Mexico's Secretariat of Environment, Natural Resources, and Fisheries	El Pinacate y Gran Desierto de Altar Biosphere Reserve Alto Gulfo y Delta del Rio Colorado Biosphere Reserve	Ajos/Bavispe Forest Reserve will soon be expanded to include the San Pedro River	Maderas del Carmen Flora and Fauna Protected Area Santa Elena Canyon Flora and Fauna Protected Area
Tohono O'odham Indian Nation	Reservation trust lands	--	--


Las Palomas WMA
Ocotillo Unit
Chinati Mtns.
State Natural Area
Elephant Mtn.
WMA
Christmas Mtns.
Big Bend
National Park
Madera
del Carmen
Canon Santa Elena
10 0 10 20 30 Miles
Map shows location
of Big Bend Region
National
Park Service
Mexican
Protected Areas
Texas Parks
& Wildlife
Texas General
Land Office
Bridges
Towns with
Crossings
Towns
Roads
Trans-Boundary Protected Areas in the Big Bend Region
Brewster & Presidio counties, Texas, USA, & Coahuila and Chihuahua, Mexico

Map 1


Transboundary Protected Areas in the Western Sonoran Desert
Arizona and California, USA and Sonora and Baja California, Mexico
Salton Sea
INWR
CALIFORNIA
ARIZONA
COLORADO RIVER
BMG Range
CPNWR
TO Reservation
BAJA CALIFORNIA
PGD BR
AGDRC BR
ORPI
SONORA
INWR—Imperial National Wildlife Refuge
BMG Range—Barry M. Goldwater Range (U.S. Air Force)
CPNWR—Cabeza Prieta National Wildlife Refuge
ORPI—Organ Pipe Cactus National Monument
TO Reservation—Tohono O'odham National Wildlife Refuge
AGDRC BR—Alto Gulfo y Delta del Rio Colorado Biosphere Reserve
PGD BR—El Pinacate y Gran Desierto de Altar Biosphere Reserve

MAP 2