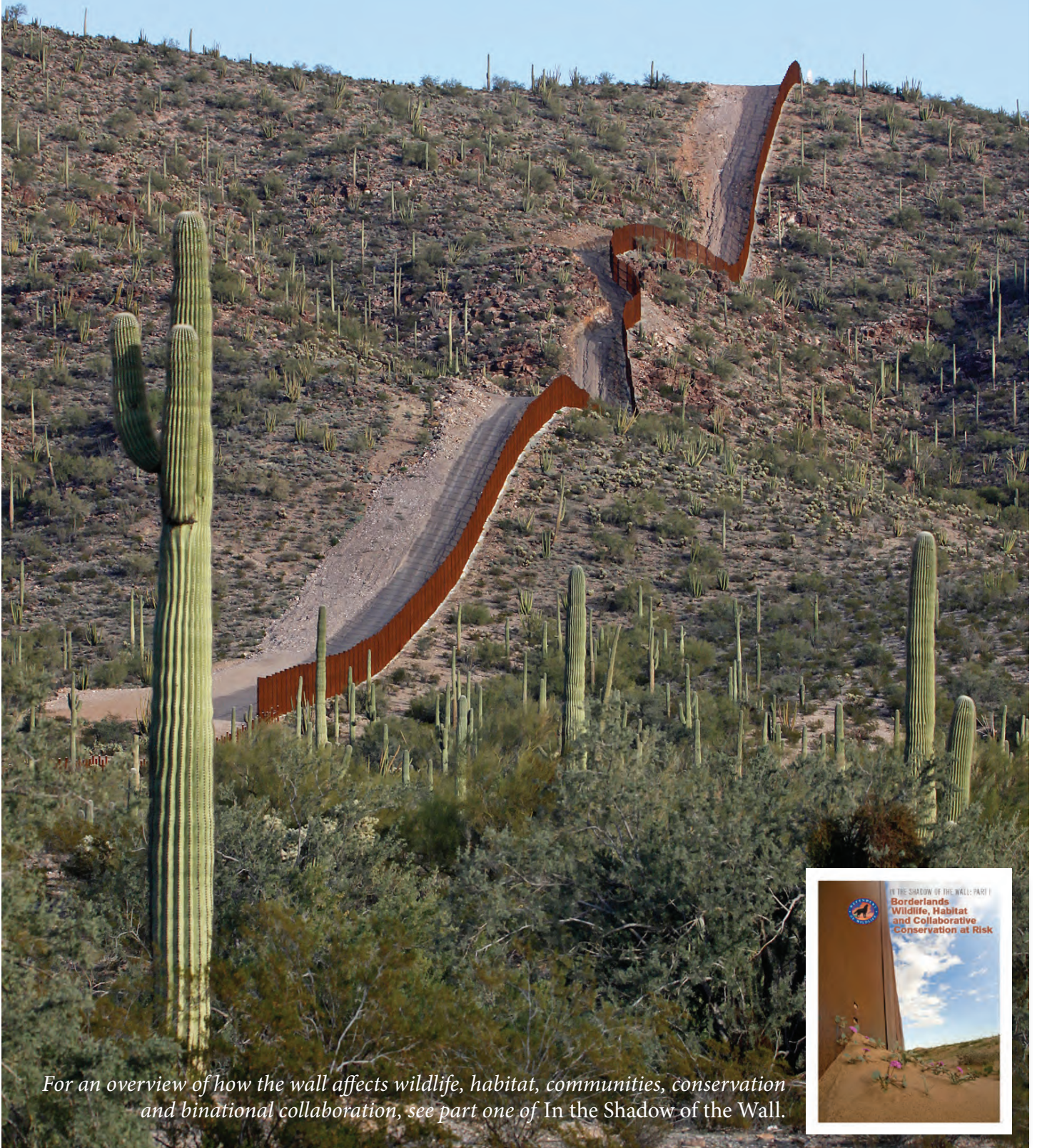


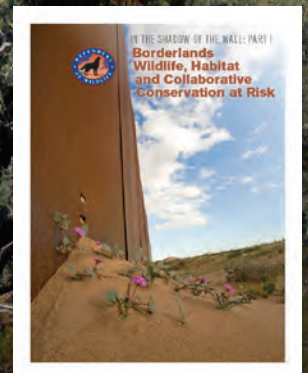


IN THE SHADOW OF THE WALL: PART II

Borderlands Conservation Hotspots on the Line



For an overview of how the wall affects wildlife, habitat, communities, conservation and binational collaboration, see part one of In the Shadow of the Wall.



IN THE SHADOW OF THE WALL: PART I
Borderlands
Wildlife, Habitat
and Collaborative
Conservation at Risk



Jamie Rappaport Clark, President and CEO

Defenders of Wildlife is a national, nonprofit membership organization dedicated to the protection of all native wild animals and plants in their natural communities.

This is part two of a two-part report on the conservation consequences of extending the wall along the U.S.-Mexico border. It zeroes in on five borderlands conservation hotspots, areas with high biological diversity and significant investments in conservation lands and conservation projects and gives voice to the people who live and work along the border. *In the Shadow of the Wall Part I: Borderlands Wildlife, Habitat and Collaborative Conservation at Risk* (published separately), provides an overview of how the wall affects wildlife, habitat, communities, conservation and binational collaboration.

Lead author

Robert L. Peters, Ph.D.
Senior Southwest Representative,
Defenders of Wildlife

Co-author

(*Californias and Sonoran Desert*)
Matt Clark, Conservation Consultant

Researcher and fact-checker

Laura Eaton, Southwest Program Coordinator,
Defenders of Wildlife

Cartographers

Matt Clark, Conservation Consultant
Matthew Moskwik, Conservation GIS Analyst,
Defenders of Wildlife

Reviewers

Matt Clark, Conservation Consultant
Rurik List, CBS Universidad Autónoma Metropolitana-Lerma
Craig Miller, Defenders of Wildlife
Scott Nicol, Sierra Club
Jerre Anne Stallcup, Terra Peninsular

Thanks to the following experts who provided additional information and insights:

Alfredo Alvarez, Loren Ammerman, Sergio Avila, Dinah Bear, Juan Carlos Bravo, Mark Briggs, Bryan Bird, Gerardo Carreón, Jeff Crooks, Mauricio De la Maza-Benignos, Tom deMaar, Owen Fitzsimmons, Jeff Francell, Jeff George, Emma Gómez, Gooch Goodwin, Lisa Haynes, Anuar D. Hernandez, Stephanie Herwick, David Hodges, Jill Holslin, David Lerma, Amy Lewis, Mirna Manteca, Dan Millis, Gary Nabhan, Sonia Najera, Kurt and Virginia Naville, Scott Nicol, Eduardo Palacios, Catalina Porrás, Andrew Rothman, Wendy Russell, Karen Schlatter, Bob and Mary Ann Severson, Jerre Ann Stallcup, Ignacio Vilchis, Jeff Weigel, Dick Zemba

© 2018 Defenders of Wildlife
1130 17th Street, NW, Washington, D.C. 20036-4604
202.682.9400
www.defenders.org

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In the Shadow of the Wall

Borderlands Conservation Hotspots on the Line

More than 600 miles of barriers already separate the United States and Mexico. The Trump administration wants to extend the wall as part of its plan to secure the entire 2,000-mile border. Extending the wall would split vital ecosystems and vast protected areas and other conservation lands in both countries, undermining decades of binational conservation work in which agencies, nongovernmental organizations and private citizens have invested hundreds of millions of dollars and countless hours to conserve habitat, imperiled species and other wildlife. “Politically the wall isolates people, culture and biodiversity,” says Gerardo Carreón, director of conservation for Mexican nonprofit conservation group Naturalia (Carreón 2017).

An impenetrable barrier at the border would limit options for re-establishing charismatic species like the jaguar, ocelot and Mexican gray wolf in the United States and restoring and sustaining international populations of species like the Sonoran pronghorn and Peninsular bighorn sheep. Even imperiled species not directly hindered by the wall—sea turtles and California condors, for example—need effective binational management to thrive.

To underscore all that is at stake in the shadow of the border wall, Defenders of Wildlife identified five “borderlands conservation hotspots” along the border’s path from the Pacific Ocean to the Gulf of Mexico (Figure 1). These are areas extending roughly 100 miles from each side of the border, a 200-mile wide band of places with high biological

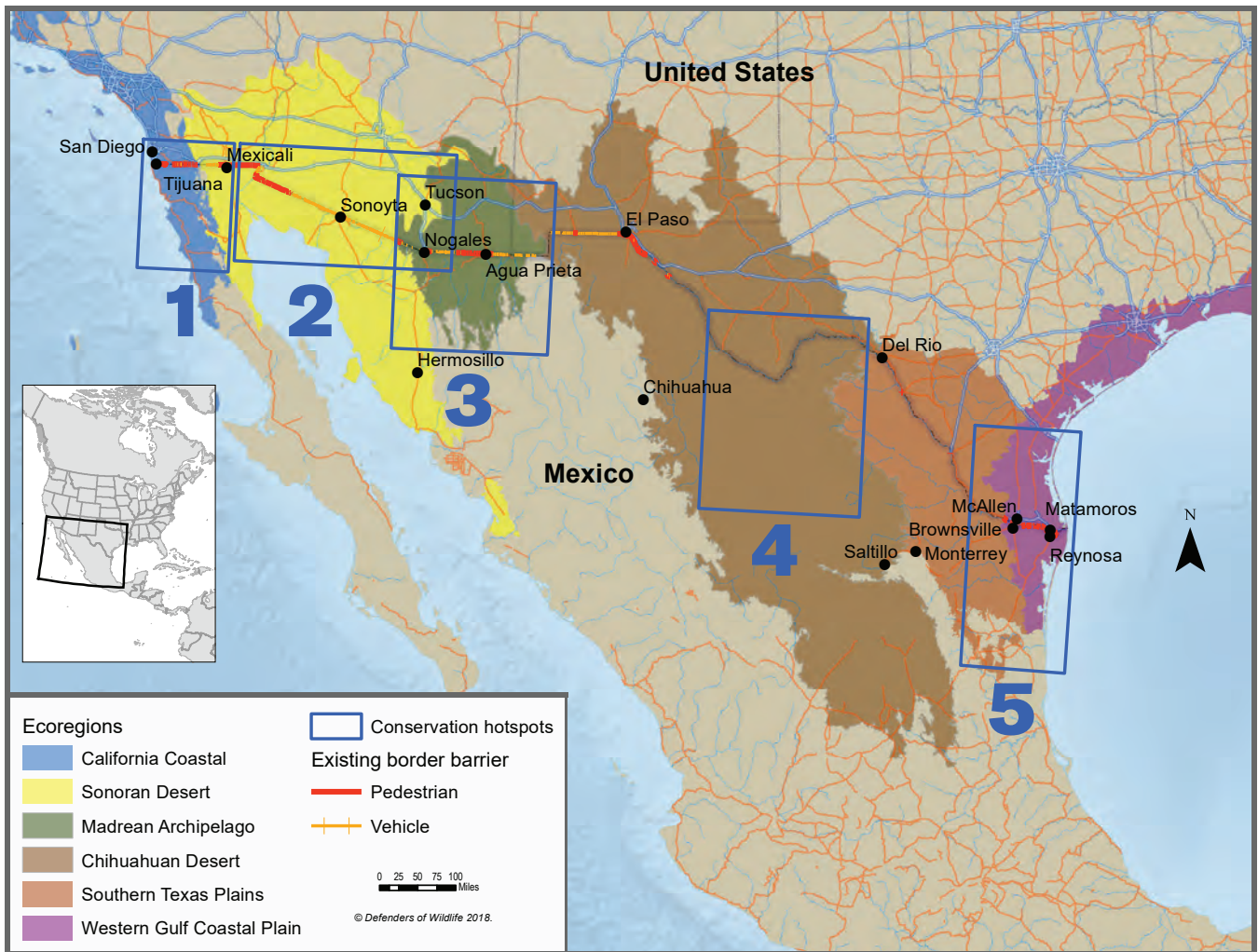



Figure 1. Borderlands ecoregions and the five conservation hotspots within them, from west to east: 1. The Californias; 2. Sonoran Desert; 3. Sky Islands; 4. Big Bend; 5. Lower Rio Grande



“Politically the wall isolates people, culture and biodiversity.”

—*Gerardo Carreón, Director of Conservation, Naturalia*

diversity, important public lands and other protected areas that harbor vital and sensitive habitats, serve as strongholds for rare and imperiled species and safeguard fragile habitats that are slow to recover from damage and already under assault from overgrazing, fire suppression, mining, water withdrawal, roads and other development. They are also places where partnerships among stakeholders and the involvement of concerned citizens are vital to conservation.

West to east, these conservation hotspots are:

1. The Californias (eastern Southern California and northern Baja California)
2. Sonoran Desert (primarily Arizona and northern Sonora, Mexico)
3. Sky Islands (northern Sonora, Mexico and southern Arizona and New Mexico)
4. Big Bend (conservation lands in the Rio Grande’s Big Bend in Texas and Coahuila, Mexico)
5. Lower Rio Grande Valley (including the Laguna Madre region on the Gulf of México in Texas and adjoining Tamaulipas, Mexico)

The five hotspots encompass significant parts of the present and potential ranges of endangered carnivores like jaguars and Mexican gray wolves, the world’s largest remaining expanse of prairie dog colonies, the last U.S. populations of ocelot and vital habitat for hundreds of species of migratory sea turtles, birds, butterflies and bats. The Californias, Sky Islands and Big Bend are in areas identified by the Critical Ecosystem Partnership Fund as among the top 36 “biodiversity hotspots” in the world, each having high numbers of unique species and under extreme threat (Critical Ecosystem Partnership Fund 2017). The Sonoran Desert ranks high in plant diversity compared to the world’s other deserts, with 2,000 species including giant saguaro cactus found nowhere else (Nabhan 2017, Phillips and Comus 1994.). Three of the hotspots, the Californias, Sky Islands and Lower Rio Grande, are in ecosystems that a 2011 study judged to be at greatest risk from the border wall (Lasky, Jetz and Keitt 2011).

The profiles of the five hotspots that follow briefly describe the conservation lands and collaborations that protect our borderlands and the looming threat the wall poses in each one. Most important, they give voice to the people doing the work of protecting borderlands wildlife and habitat: ranchers who have spent thousands to restore degraded lands, retirees who volunteer at national wildlife refuges, academics engaged in understanding and restoring threatened ecosystems. These profiles testify to the productive partnerships and binational cooperation—the keys to successful borderlands conservation that the push to militarize our southern border threatens to take away. As Gerardo Carreón puts it, “How can we collaborate when we have to do it across a wall? How can we make this connection if there isn’t a physical connection between the ecosystems because the wall separates them?” (Carreón 2017).

REPORTS FROM THE BORDER

The Trump administration’s vow to extend the wall has inspired a flurry of science-based reports. The federal Good Neighbor Environmental Board submitted a report to the president and Congress concluding that “the wall and associated infrastructure would block gene flow and migration for species like Sonoran pronghorn, bighorn sheep and Mexican long-nosed bats” (Good Neighbor Environmental Board 2017). The Wildlands Network released an in-depth assessment of how the wall could contribute to the disappearance of four flagship species from the borderlands: Sonoran pronghorn, jaguar, black bear and Mexican gray wolf (Bravo and Davis 2017). The Center for Biological Diversity produced a report identifying 93 threatened, endangered and candidate species with cross-border ranges, concluding that the wall “will be an unmitigated disaster for both people and wildlife” (Greenwald et al 2017). Scientific overviews relevant to the border include Flesch et al (2010), Lasky, Jetz and Keitt (2011), Trouwborst, Fleurke and Dubrulle (2016), and List (2007) in Cordova and de la Parra (2007). This Defenders of Wildlife report addresses impacts on wildlife and habitat, but also emphasizes the conservation lands, collaborations and success stories that make a compelling case against the wall.

Borderlands Conservation Hotspot

1. The Californias



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Beginning at the coast, fencing marks 46 miles of the 60-mile border between San Diego County and Mexico.

The coastal area of southern California and northern Baja California, Mexico (the Californias, for short) has it all: beaches, mountains, great weather, cultural diversity—and more miles of border fencing than anywhere else on the U.S.-Mexico border. Seventy-two percent of the California border is blocked by pedestrian fencing according to recent figures (USBP 2017). The densely populated and rapidly growing region also has extremely high biodiversity and hundreds of imperiled species (Stallcup et al 2015). With so many natural assets at stake, the region has become “a hotbed of binational cooperation,” says Jerre Ann Stallcup, a conservation ecologist who has worked for over 20 years in the California borderlands and worries about the effects of wall building on cross-border collaborations and conservation investments (Stallcup 2018).

The Californias’ Mediterranean climate accounts for its biodiversity—cool, moist winters and warm, dry summers and mixture of northern temperate and arid southern habitats. Coastal sage scrub, chaparral, and oak and conifer woodlands are common. Cottonwood and willow forests line freshwater streams, and vernal pools provide seasonal oases for rare species like endangered San Diego fairy shrimp (U.S. Fish and Wildlife Service [FWS] 2017a). Further inland, east of the Jacumba Mountains and Peninsular Ranges, much drier and hotter conditions favor creosote and saltbush scrub, sandy grasslands, dunes and other desert ecosystems.

The Californias sustain over 400 species of plants and animals classified as endangered, threatened or at risk, including the endangered California condor, Peninsular bighorn sheep and Quino checkerspot butterfly (Stallcup et al 2015). The region is part of the larger California Floristic Province identified in 1996 by the International Union for the Conservation of Nature (IUCN) as one of the world’s most biologically important and imperiled regions (Critical Ecosystem Partnership Fund 2018). At least 75 percent of the original habitat in the province has already been lost (California Academy of Sciences 2017).

Border-security infrastructure and activities—including buildings, roads, night lighting, round-the-clock patrols, vehicles and helicopter flights—pose a whole other set of threats to wildlife and conservation lands already under pressure.

UNDER PRESSURE

The growth of the San Diego and Tijuana metropolitan areas—home to more than four million people—drives commercial, residential and transportation development and increasing off-road vehicle activity, pollution, habitat loss and wildfires in the Californias. In the last decade, fires destroyed thousands of acres of rare Tecate cypress (Stallcup et al 2015). Vernal pools are down to 10 percent of their historic extent (California Department of Fish and Game 1998), native grasslands to a mere 1 percent (California Native Grasslands Association 2018).

Urbanization poses the largest single threat to the endangered Peninsular bighorn sheep, with motor vehicles and poisonous ornamental plants introduced by homeowners and developers causing an equal number of deaths (Bighorn Institute 2018). Along the border, Interstate 8 in California and Mexican Highway 2 in Baja California fragment the landscape and encourage sprawl. Tijuana and Playas de Rosarito are spreading south along the coast and east toward Tecate, Ensenada is heading north.

Conservation lands

The U.S. side of the border has many protected federal and state lands (Figure 2a). Several small reserves near the coast are surrounded by human development, including the Tijuana River National Estuarine Research Reserve, Tijuana Slough National Wildlife Refuge and San Diego Bay National Wildlife Refuge. Inland reserves—most of which are much larger—include Cuyamaca Rancho and Anza-Borrego Desert state parks, Rancho Jamul and Sycuan Peak ecological reserves, and the federally designated Otay Mountain, Carrizo Gorge, Jacumba, Pine Creek and Hauser wilderness areas. These coastal and inland reserves total more than 1,000 square miles. Additional multi-use public lands offer varying levels of protection for habitat and wildlife corridors among more strictly protected lands.



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Where not negated by Real-ID-Act waivers, U.S. critical habitat designation offers another layer of protection for endangered and threatened species like the coastal California gnatcatcher, least Bell's vireo, western snowy plover, Quino checkerspot butterfly, Arroyo toad, San Diego fairy shrimp and Peninsular bighorn sheep.

The Mexican side of the border has two protected areas (Figure 2b). The 19-square-mile federally owned Parque

WALLS, WAIVERS AND ENVIRONMENTAL DESTRUCTION

In 2009, the Department of Homeland Security (DHS) invoked the Real ID ACT of 2005, which allows the agency to waive “all legal requirements... necessary to ensure expeditious construction of the barriers and roads,” and completed 14 miles of pedestrian fencing at the westernmost edge of the San Diego-Tijuana border (State of California v. United States 2017).



Previous page: Laborers construct a section of border wall. Above: To create this earthen berm that accommodates Border Patrol traffic, DHS waived environmental requirements and filled in Smuggler's Gulch, an ecologically significant canyon.

The building project included filling Smuggler's Gulch—an ecologically important canyon—with over 2 million cubic yards of dirt, creating a 145-foot-high berm topped by a road to allow border patrol vehicles access along both sides of a high wall (At The Edges 2018). The California Coastal Commission opposed this development, concluding that it would have significant, long-term adverse effects on the Tijuana River Estuarine Research Reserve, Border Field State Park and endangered species (California Coastal Commission 2003). Nevertheless, the project proceeded, resulting in habitat loss and increased erosion and water surges carrying harmful sediment that covers habitat for endangered Ridgway's rail and other species in the Tijuana Estuary (State of California v. United States 2017, Innes 2016).

DHS also used Real-ID-Act authority to waive the Wilderness Act and other laws to build a 3.6-mile stretch of wall and a five-mile patrol road across the southern boundary of the 30-square-mile Otay Mountain Wilderness Area (Innes 2016), subverting the congressional intent of wilderness designation and irreversibly damaging protected lands and wildlife. This wilderness area provides habitat for 20 sensitive plant and animal species, including the endangered Quino checkerspot butterfly (Bureau of Land Management [BLM] 2018), the largest remaining population of Tecate cypress—listed as endangered by the International Union for the Conservation of Nature (IUNC 2018), and the only known population of rare Mexican flannel bush (U. S. Congress 1999).

Prior to the waiver, a DHS draft environmental impact statement found the project would have long-term, adverse impacts on the plant, animal and hydrological resources of the area (DHS et al 2007). With laws nullified by the waiver, heavy equipment rolled in to drill and blast away steep slopes to clear 500,000 cubic yards of earth and rock (Torline and Gruszecki 2010). The impacts included extensive erosion, habitat fragmentation, felling of Tecate cypress trees and loss of wilderness values like solitude (Millis 2018).

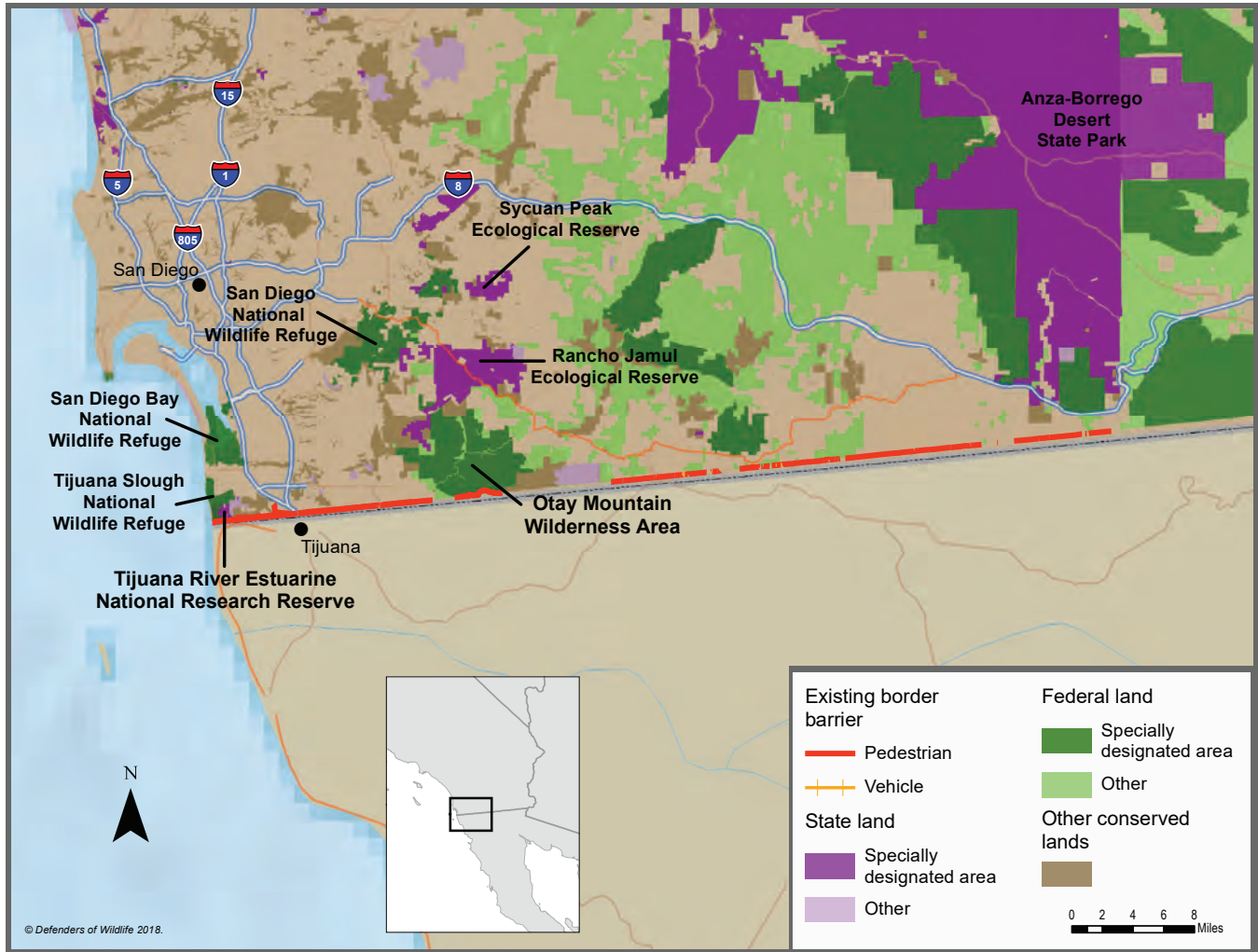


Figure 2a. Protected areas in the California from the Tijuana Estuary west to Anza Borrego State Park

Nacional Constitución de 1857, 45 miles south of the border, protects higher elevation coniferous forest and shrubland, shallow freshwater lakes, ponds and meadows (Comisión Nacional de Áreas Naturales Protegidas [CONANP] 2006). The mountainous 282-square-mile federally owned Parque Nacional Sierra de San Pedro Mártir, 127 miles from the border, protects high-elevation coniferous forests and, in the lowlands, chaparral and desert shrub. Both parks support golden eagles, mountain lions, bobcats, ringtails, mule deer and Peninsular bighorn sheep (CONANP 2006, 2007). San Pedro Mártir is also a California condor reintroduction site, part of a binational effort to restore these birds absent from Mexico since 1937 (University of California Institute for Mexico and the United States [UCMEXUS] 2003).

Collaborative conservation

To protect conservation lands, wildlife and other natural resources, nonprofits, institutions and government agencies

in California and Mexico regularly collaborate. Notable examples are summarized below.

Identifying conservation priorities

South Coast Missing Linkages Project. In 2002, conservation and research organizations working in the South Coast Ecoregion partnered to identify the most important remaining habitat linkages between protected areas (Penrod et al 2006). Their efforts have protected key U.S. parcels from development. Group members are also working with transportation agencies to include wildlife overpasses and underpasses on some of the region’s busiest highways. Partners include more than 20 U.S. and Mexican agencies and organizations, including U.S. Forest Service, National Park Service, BLM, California State Parks, Conservation Biology Institute, South Coast Wildlands, The Nature Conservancy, Conabio, Pronatura and the Universidad Autonoma de Baja California.

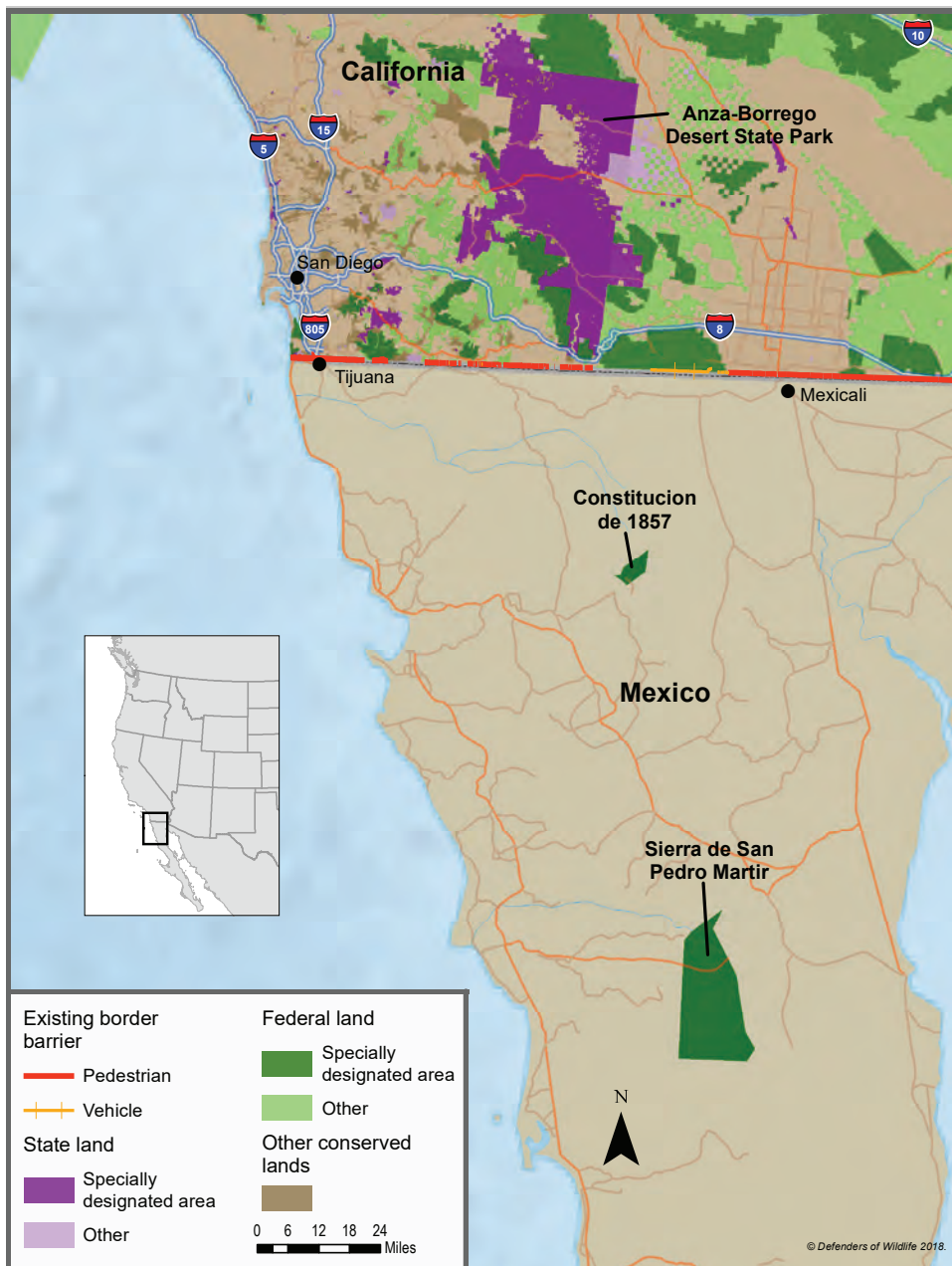


Figure 2b. Protected areas in the Californias from Anza Borrego State Park south to Sierra de San Pedro Mártir

Las Californias Binational Conservation Initiative

(LCBCI). After the South Coast Missing Linkages Project brought attention to the interdependence of borderlands species and highlighted the lack of protected areas on the Mexican side, LCBCI formed to identify essential areas for conservation. Members include the Conservation Biology Institute, The Nature Conservancy, Terra Peninsular, Pronatura, BLM, FWS, California Department of Fish and Wildlife, CONANP and Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT).

LCBCI assessed habitat losses in the Californias from 2004 to 2014 and documented some staggering ones in a 2015 report. Within the study area, valley grassland had decreased 48 percent in Baja California and 36 percent in California (Stallcup et al 2015). Development or border wall had closed off three of the remaining wildlife linkages between U.S. and Mexican refuges identified by LCBCI in a 2004 report (Stallcup 2018). LCBCI is now calling for agencies and nongovernmental groups in the two countries to protect the only remaining linkage, which runs down the Sierra Juárez mountains to Parque Constitución de 1857. (Stallcup et al 2015). This linkage would maintain connections between U.S. and Mexican populations of mountain lions, Peninsular bighorn sheep, California condors and golden eagles.

The rapid rate of habitat loss documented in LCBCI's 2015 report underscores an urgent need to create sister reserves in Baja California to safeguard a continuous swath of habitat north and south of the border.

This will require a substantial increase in funding and political will in Mexico and close collaboration among organizations and agencies on both sides of the border.

Cooperating on conservation planning
Natural Community Conservation Planning (NCCP). California's Natural Community Conservation Planning Act provides mechanisms for decreasing conflict between development and conservation. The NCCP establishes a

legal framework that California municipalities have used to develop species conservation plans approved by FWS and the California Department of Fish and Wildlife.

With multiple southern California species facing extinction because of habitat loss, municipalities have created conservation plans that nest within the state's NCCP framework. For example, the **San Diego Multiple Species Conservation Program** (MSCP) covers the southwest portion of San Diego County. In this area that encompasses 900 square miles and borders Mexico, MCSP is preserving 171,920 acres (City of San Diego 2018) to ensure long-term survival of imperiled species while allowing development in other areas. Jurisdictional subareas, including unincorporated portions of San Diego County, the cities of San Diego and Chula Vista, are implementing the plan. The MSCP area abuts other NCCP plans within San Diego County and within Orange and Riverside counties to the north. But to the south in Mexico, no comparable regional planning program exists.

Development of the MSCP plan required six years of negotiation between public and private partners across the region. As of 2016, San Diego County has protected 75,450 acres of high value habitat in its unincorporated area (San Diego County 2018), invested \$35.5 million in land protection and leveraged another \$34 million (San Diego County 2017). The city of San Diego, in addition to its own subarea plan, developed a complementary **Vernal Pool Habitat Conservation Plan** to improve and streamline the environmental permitting process and minimize impacts to vernal pool species, including Otay Mesa mint, California Orcutt grass and San Diego fairy shrimp (City of San Diego 2017).

Sonoran Joint Venture. An FWS-supported binational group of more than 50 agencies, nonprofits and universities, the Sonoran Joint Venture leverages local, state and federal funds to carry out bird conservation projects in the U.S. Southwest and western Mexico, including southern California and Baja California (Sonoran Joint Venture 2018a). One 2016 grantee, the Southern Sierra Research Station, hosted workshops to train Mexican biologists to assess and monitor Mexican bird populations in trouble (Sonoran Joint Venture 2018b).

Protecting cross-border species

California condors. The recovery of the California condor—the largest land bird in North America—requires a widespread population in their historical range in California and Baja



© DOUGLAS CROFT

Full recovery of the California Condor hinges on binational cooperation.

California (FWS 2016a). In 1987, FWS and the San Diego Zoo pioneered a program to raise condors for release in the wild after loss of habitat and food sources, shooting and poisoning from lead and other chemicals had reduced the population to a mere 27 individuals (California Department of Fish and Wildlife 2018). Today nearly 250 condors fly free in the United States (FWS 2016b). Another 36 live in the wild in Baja California, centered around the Mexican release site in Parque Nacional Sierra de San Pedro Mártir, and sometimes venture into the United States (Porras 2018).

Mexicans Juan Vargas and Catalina Porras lead the team that raises condors for release at Sierra San Pedro de Mártir. When the program started in 2002, Vargas and Porras lived in a tent at the remote reintroduction site to acclimate and monitor the birds. Today, the juvenile condors they helped reintroduce are successfully reproducing adults. “We believe that in the future the flock flying free in California and the ones flying here in Mexico will merge,” says Porras.

Currently a memorandum of understanding between the United States and Mexico allows the transfer of condors and their eggs across the international border for conservation. Work is coordinated through the binational California Condor Recovery Team, with a major role played by the San Diego Zoo. “Our Mexican partners are wonderful,” says Ignacio Vilchis, the zoo’s associate director of recovery ecology. “We’ve worked together to establish a self-sustaining condor reintroduction program at Sierra San Pedro de Mártir” (Vilchis 2018). That goal is on the horizon: Offspring

from two breeding pairs at Mexico City's Chapultepec Zoo were recently released at the Sierra de San Pedro Mártir site—a milestone for the Mexican program and binational condor recovery.

Peninsular desert bighorn sheep. Once widespread in California and Baja California, in its current range (Figure 3) the desert-adapted Peninsular bighorn sheep now numbers fewer than 1,000 in Southern California, 2,000 to 2,500 in Mexico (Bighorn Institute 2018). Critical habitat designated by FWS for the species extends south to the border, and females from the U.S. Jacumba ewe group cross into Mexico to lamb and find summer water (Colby and Botta 2015). “There’s a break in the border fence because there’s very rough terrain in that area,” says researcher Asako Navarro. “We are seeing not only movement back and forth from the border, but use of the habitat by the peninsular bighorn sheep” (Binkowski 2015). Maintaining such connectivity between the U.S. and Mexican sheep is an important goal in the FWS

“The wall undermines a decade of massive financial investment in southern California conservation lands and makes it harder to ensure the future of species like the endangered Peninsular bighorn sheep.”

—*Jerre Ann Stallcup, ecologist*

recovery plan, and the long-term health of the population will depend on cooperation between U.S. and Mexican agencies.

Light-footed Ridgway’s rail. Loss of coastal wetlands to development in southern California and northern Baja California pushed Ridgway’s rail (formerly the light-footed clapper rail) to the edge of extinction. The Tijuana Estuary downhill from Smuggler’s Gulch supports the second-largest U.S. population of 70 to 120 nesting pairs in any given year, while a larger population exists in Mexico at Bahía San



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Parque Nacional Sierra San Pedro Mártir in Baja California is known for its pine trees, rock formations and recently reintroduced California condors.



Figure 3. Peninsular bighorn sheep range

Quintín south of Ensenada. A U.S. captive-breeding program started in 1998 is raising rams to augment the wild population, but fragmented U.S. populations have lost genetic diversity. One solution under consideration to introduce new genes is collecting eggs from the San Quintín population to rear in the United States. “The best conservation strategy for the bird’s long-term survival is strong binational cooperation,” says Eduardo Palacios, shore-bird specialist with Centro de Investigación Científica y de Educación Superior de Ensenada (2018). “We need genetic exchange between the two countries so populations stay healthy.”

Blocked wildlife movement. Completing the wall across the California-Mexico border would dash hopes for protecting vital habitat connections between southern California and northern Baja. The finished wall would undermine conservation efforts even for common species like the mountain lion. Endangered U.S. Peninsular bighorn sheep would be blocked from lambing habitat and summer water sources in Mexico (California Department of Fish and Wildlife 2015), and genetic connections between U.S. and Mexican populations demonstrated by recent research would be lost (Fleisch et al 2010). Because the

Quino checkerspot butterfly.

The small orange-and-white Quino checkerspot once flitted throughout much of southern California and Baja California, but populations are now down by more than 95 percent (FWS 2003). FWS listed the Quino checkerspot as endangered and designated critical habitat, which extends to the U.S. border. The FWS recovery plan notes that survival of the U.S. population near the border may depend on recruitment from source populations in Baja California, notably one on Jesús Maria Mesa, next to an unwalled section of the border.

The looming threat of the wall

In addition to normal enforcement operations, the California border is enduring a flurry of activity as DHS’s designated border wall testing site. Eight wall prototypes completed in late 2017 now stand in Otay Mesa, south of San Diego. According to Reuters news reports, DHS also plans 26 miles of new or replacement fencing in the Californias (Ainsley 2009).

Quino checkerspot butterfly generally avoids flying over objects taller than seven feet (USFWS 2003), a 30-foot wall could genetically isolate the small U.S. border population from the larger source population on Jesús Maria Mesa, threatening its long-term survival (Stallcup 2004).

Hurdle to binational conservation. The wall and associated security complicate binational collaborations. Jeff Crooks, a scientist with the Tijuana River National Estuarine Research Reserve, works closely with Mexican partners to clean up contaminated water flowing into the Tijuana Estuary, where it forces beaches to close and buries habitat for Ridgway's rails with sediment. "My job is to get U.S. and Mexican scientists to meet," he says, "but this is really difficult when it can take hours to cross the border." Long-time area conservationist Jerre Anne Stallcup has additional concerns: "Further extending the wall, would undermine the long history of binational collaboration and investment of public funds that support conservation and provide border communities clean air and water" (Stallcup 2018).

Direct harm to biological resources. "The fence and associated infrastructure are changing the topography and altering ecosystem processes and natural water flow in the Tijuana watershed. Stallcup says (Stallcup 2018). In a complaint filed with the federal government in 2017, the state of California cites documented impacts from the existing walls: "Construction of the wall resulted in the destruction of sensitive upland and wetland habitats, the taking of endangered plant and animal species, the spread of invasive plant species, and the increase in sedimentation within Border Field State Park and the Tijuana Reserve." The state claimed that additional construction proposed by the current federal administration "will negatively impact sensitive biological habitats near the border as well as endangered and/or specially listed plant and animal species (State of California v. United States 2017).

Diversion of resources. As LCBCI documented in its 2015 report, time is running out to preserve the last remnants of habitats in the coastal zone and to keep the last major wildlife corridor between California and Baja intact. Money that could address conservation challenges may instead build a wall that will add to the challenges. Moreover, given current political priorities in the United States, the

"Our tax dollars should be invested in supporting our ports of entry that create jobs and further generate economic benefits. We should not waste funding on an unnecessary wall that would cost our region jobs and revenue, or damage our environment."

—*Georgette Gomez, San Diego councilwoman*

small amount of federal money provided for conservation in past years is likely to shrink even more—U.S. support for condor reintroduction in Mexico has already been cut.

Undercutting conservation investments. The wall undermines a decade of massive financial investment in southern California conservation lands and makes it harder to ensure the future of species like the endangered Peninsular bighorn sheep (Stallcup 2018). When Smuggler's Gulch was filled in 2009, the executive director of the California Coastal Commission, Peter Douglas, said, "Not only is it a wall of shame, but to override the protections after the state spent tens of millions of dollars to restore the estuary and to just come in and blast the place... it's just shameful" (Reese 2009).

Impact on trade and tourism. Border walls can put a substantial dent in income from ecotourism. As San Diego councilwoman Georgette Gomez wrote in an editorial in the *San Diego Union Tribune*, "The wall will also negatively affect our city's trade and tourism revenue. Our tax dollars should be invested in supporting our ports of entry that create jobs and further generate economic benefits. We should not waste funding on an unnecessary wall that would cost our region jobs and revenue, or damage our environment." Recognizing this the San Diego City Council passed a resolution in September 2017 opposing further wall construction (Garrick 2017).



Borderlands Conservation Hotspot

2. Sonoran Desert



GEORGE BENTLEY/FWS

The Sonoran Desert has 2,000 endemic plant species—more than anywhere else in North America.

Think deserts are wastelands? A visit to one of the national monuments or national wildlife refuges in the Sonoran Desert could change your mind. These borderlands are teeming with plants and animals impressively adapted to extreme conditions. During your visit you might encounter a biologist, a volunteer or a local activist in awe of the place and dedicated to protecting it. The Sonoran Desert is so important to the natural heritage of the United States and Mexico that both countries are vested in conservation lands and programs and on a joint mission to preserve it. “A border wall,” says one conservation coalition leader, “harms our mission” (Campbell 2017).

The Sonoran Desert is one of the largest intact wild areas in the country, 100,387 square miles stretching across the southwestern United States and northwestern Mexico. This desert is renowned for columnar cactuses like saguaro, organ pipe and cardón. Lesser known is the fact that the Sonoran Desert has more endemic plant species—2,000—than anywhere else in North America (Nabhan 2017).

The desert and its forested mountains support a surprising variety of wildlife: 60 species of mammals, 350 birds, 20 amphibians, 100 reptiles and 30 native fish, many of them imperiled (National Park Service [NPS] 2016b). Endangered cactus ferruginous pygmy-owls occupy lush streamside habitats and bajadas—gentle slopes at the foot of desert

mountains, where they find nesting cavities and swoop between cactuses and trees to hunt lizards and other prey. Rare desert bighorn sheep stick to the steep, rocky slopes of isolated desert mountain ranges where they keep a watchful eye for predators. One of the most endangered mammals in North America, Sonoran pronghorn still occasionally cross the border in search of food and water in the dry Sonoran Desert (Wildlands Network 2017).

The biological diversity of the fragile Sonoran landscape derives from a confluence of conditions that allow temperate and tropical species to intermingle: a warm subtropical climate, two yearly pulses of precipitation, dramatic elevation gradients and varied geology. The Colorado River—the

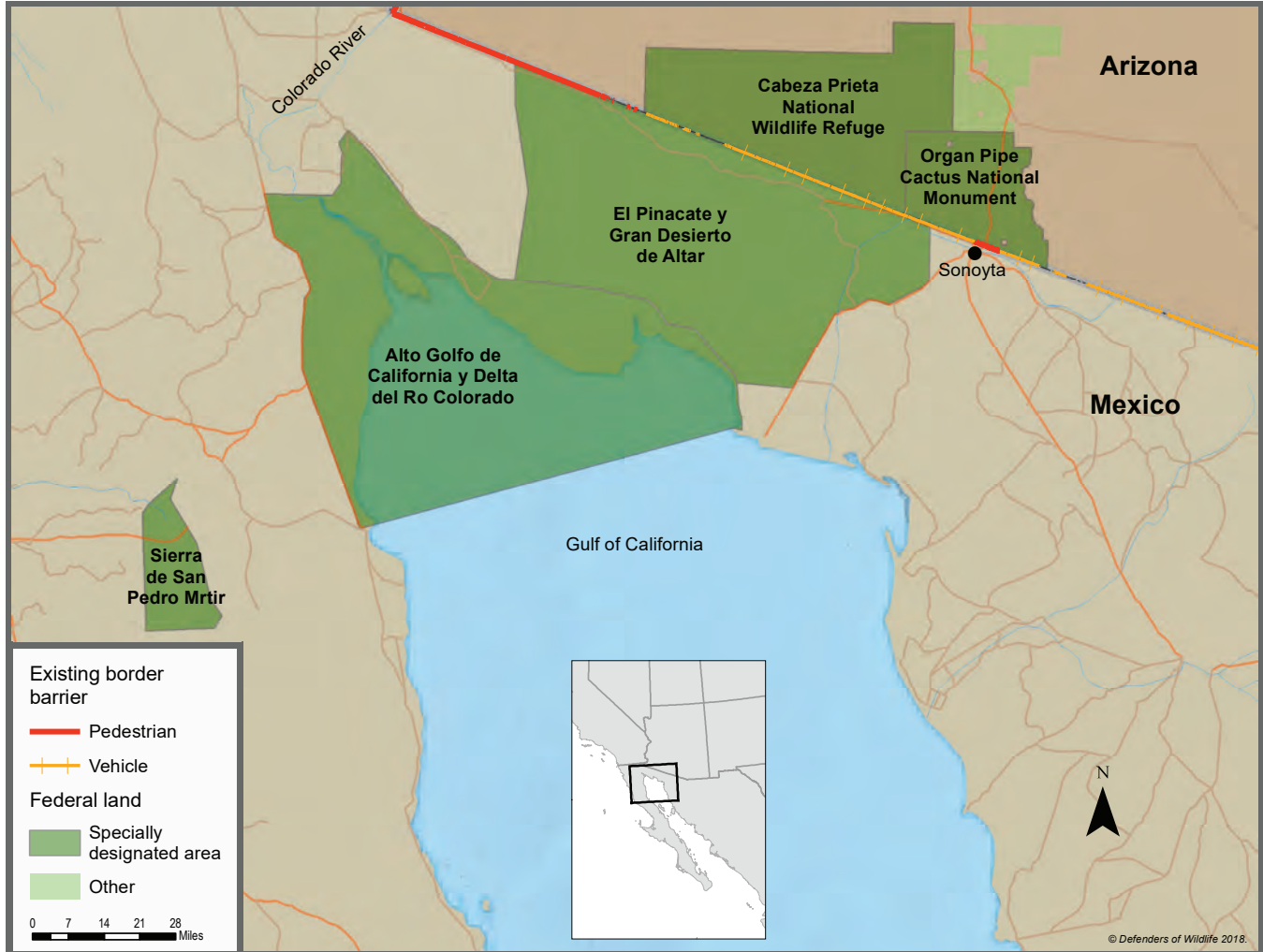


Figure 4. Protected areas in the Sonoran Desert

most important source of renewable freshwater in the arid Southwest—and the Santa Cruz and San Pedro rivers and their tributaries further enhance the desert’s diversity. These waters provide aquatic and riparian habitats that sustain an abundance of wildlife, including many now imperiled species like the southwest willow flycatcher and Gila topminnow.

Conservation lands

Protected areas on both sides of the border safeguard the diverse and delicate Sonoran Desert (Figure 4).

In Mexico, the 2,500-square-mile El Pinacate y Gran Desierto Biosphere protects a diverse mosaic of intact desert habitats, including large maternity caves crucial for the endangered lesser long-nosed bat. The landscape includes granite massifs, circular volcanic craters and the largest dune system in North America. The subtropical desert ecosystem hosts more than 44 mammals, 200 birds, and 40 reptiles (United Nations Educational, Scientific and

Cultural Organization [UNESCO] 2017). The adjacent Alto Golfo de California Biosphere Reserve, 6,378 square miles, has extremely varied habitats, including desert and coastal beaches and dunes. The reserve extends into the Gulf of California where it provides some protection for the tiny vaquita, the smallest and possibly rarest cetacean.

On the U.S. side is a dense patchwork of lands protected for biodiversity that includes Organ Pipe Cactus National Monument, more than 517 square miles set aside in 1937 to preserve a prime example of Sonoran Desert ecosystem; 1,343-square-mile Cabeza Prieta National Wildlife Refuge, home of a Sonoran pronghorn captive breeding program; and Buenos Aires National Wildlife Refuge, 183 square miles in the Altar Valley protected in 1985 to recover the endangered masked bobwhite quail, a species still struggling in the United States and Mexico because of overgrazing, invasive species and drought (U.S. Fish and Wildlife Service [FWS] 2014a). Also important are Kofa National Wildlife Refuge,

Sonoran Desert and Ironwood Forest national monuments and Saguaro National Park, plus many multi-use national forest lands, conservation easements on private ranchlands and some 200,000 acres protected by Pima County (Coalition for Sonoran Desert Protection [CSDP] 2017a).

Conservation collaborations

Conservation in the Sonoran Desert brings together state, federal and tribal land protection and wildlife agencies, local governments, nongovernmental organizations and citizens. From broad-based binational programs to more targeted efforts, they strive to protect species and to restore, acquire and connect habitat.

Citizens in action

Citizens have banded together in local conservation groups to protect their beloved desert and its flora and fauna. These include the Altar Valley Conservation Alliance, Coalition for Sonoran Desert Protection and Friends of the Sonoran Desert.

Conservation-minded landowners in south-central Pima County formed the Altar Valley Conservation Alliance to protect and restore the valley's semi-desert grasslands (Altar Valley Conservation Alliance 2017), complementing Pima County's projects to enhance habitat on county lands in the valley, as well as the county's mitigation bank that protects habitat for the endangered Pima pineapple cactus (Pima

SONORAN SPRAWL

Amid the relatively pristine expanses that remain in the Sonoran Desert stretches the Arizona Sun Corridor, an exploding area of growth that encompasses Phoenix, Tucson and Agua Prieta, Mexico. The corridor's 2010 population of 5.6 million is expected to reach 12 million by 2050 (America 2050 2017), putting intense pressure on fragile land and water resources. Suburban sprawl in Tucson contributed to the plight of the cactus ferruginous pygmy-owl (Johnson et al 2004), and demand for water dried up the U.S. side of the once-navigable Santa Cruz River. All that remains is a short stretch of riparian vegetation sustained by treated sewer water from the two Nogales, neighboring cities of the same name on either side of the border (Sprouse 2005).

“Tourism is a major element of our local economy. The militarization and environmental damage that come with the border wall do not enhance tourism.”

—Richard Elias, Pima County Supervisor

County 2017a). To date, the alliance has directed some \$4 million to improving grazing lands while benefiting the watershed and native species (Pima County 2015).

With 30 member groups, including Defenders of Wildlife, the Coalition for Sonoran Desert Protection (CSDP) uses citizen volunteers to watchdog development and help agencies plan projects. The coalition recently worked on the installation of a wildlife overpass on Oracle Road north of Tucson with the Arizona Department of Transportation, Arizona Game and Fish Department and Pima County.

Binational ventures and projects

The Sonoran Joint Venture protects birds and their habitats by coordinating conservation work on both sides of the border. The joint venture offers a competitive grant program, which currently supports 19 U.S. and Mexican organizations working on projects like bird surveys, habitat monitoring and public education and outreach.

The Mexico Program of FWS works with Mexico's Secretariat of Environment and Natural Resources and other partners on both sides of the border to monitor, protect and recover at-risk species like the Chiricahua leopard frog, flat-tailed horned lizard, Sonoyta mud turtle, lesser long-nosed bat, cactus ferruginous pygmy-owl and Sonoran pronghorn (Fernandez et al 2009).

FWS's Wildlife Without Borders Program recently awarded a grant to the Wildlands Network, an international conservation organization that promotes wildlife corridors and wide-ranging species from Canada to Mexico. The grant supports the group's work with Mexican transportation authorities to determine where to put wildlife passages across Mexico's Highway 2 (Bravo 2017a), a dangerous east-west barrier for jaguars, Sonoran pronghorn and other wildlife. Mexican biologists are inventorying culverts and other wildlife-crossing structures on Highway 2 and monitoring how animals use them. The Sky Island Alliance and Cuenca



CONSERVATION COALESCES IN PIMA COUNTY

Pima County, 9,189 square miles in southeastern Arizona, which shares 100 miles of border with Sonora, Mexico, has a county-wide commitment to protecting sensitive borderlands.

In 2001, Pima County approved the Sonoran Desert Conservation Plan, which identifies high-priority conservation lands where development is discouraged (Pima County 2017b). The county was also part of a years-long planning process involving ranchers, developers, conservationists, scientists, the Tohono O'odham Nation and FWS that resulted in the landmark Pima County Multi-Species Conservation Plan. Released in 2016, that plan spells out steps for protecting endangered species.

To meet its conservation goals, the county spent \$202 million in voter-approved bonds to purchase over 71,000 acres, including large intact ranches (CSDP 2017b). The county also leased more than 130,000 acres of state trust land for conservation, many of which remain open to grazing.

A driving force behind Pima County's desert and species conservation plans was agreement by stakeholders that protected open space attracts tourism and business. A study commissioned by the Tucson Audubon Society estimated spending on watchable wildlife recreation alone in Pima County at \$179,459,718 in 2011 (Tucson Audubon Society 2013). This spending stimulated a broader economic impact of \$304,338,133, generating \$19,866,395 in state and local taxes.

"Tourism is a major element of our local economy," says Pima County supervisor Richard Elias. "The militarization and environmental damage that come with the border wall do not enhance tourism." (Elias 2017).

Carolyn Campbell, executive director of the Coalition for Sonoran Desert Protection, worked with Elias on both conservation plans and a new wildlife overpass north of Tucson. "Here in Pima County," she says, "we are investing in open space and wildlife crossings to overcome highways and other man-made barriers" (Campbell 2017). The border wall is the ultimate barrier.

Los Ojos, a foundation that works on both sides of the border, are monitoring roadkill.

Saving Sonoran pronghorn

For the moment, populations of the endangered Sonoran pronghorn in the United States and Mexico are small but rebounding from a low of 19 individuals in 2002 (Springer 2009), thanks to close cooperation among the Arizona Game and Fish Department, FWS, Organ Pipe Cactus National Monument, Cabeza Prieta National Wildlife Refuge and Mexico's Gran Desierto de Altar Biosphere Reserve (El Pinacate). Mexican and U.S. agencies coordinate a biannual aerial census that in 2015 counted 1,050 wild Sonoran pronghorn in the United States and Mexico (Mazon 2017).

U.S. efforts include a captive-breeding program on Cabeza Prieta and Kofa national wildlife refuges (Springer 2009). In Mexico, staff at El Pinacate reserve, which was designated in part to protect pronghorn habitat, educate visitors and landowners and contend with challenges like off-road vehicles, over-use of water and pressures to open the reserve to



STEVE HILLEBRAND/FWS

Connectivity between the U.S. and Mexican populations of Sonoran pronghorn is vital to the survival of this highly endangered species.

incompatible uses like agriculture (Grageda 2017).

El Pinacate's coordinator of natural resources, Miguel Angel Grageda, works closely with U.S. counterparts. "We share ideas and experiences and help each other solve problems," he says (Grageda 2017). As an example he cites genetic work underway at the University of

Arizona that will help identify the most important areas for connecting pronghorn populations—information needed to maintain corridors between the larger, genetically richer El Pinacate population and the isolated U.S. population (Krausman et al 2005).

Restoring the Colorado River Delta

The Colorado River is dammed and tapped along its course to meet the agricultural and household water needs of nearly 40 million people. At the delta, where the river now rarely meets the sea in the Gulf of California, water withdrawal and a prolonged drought have killed delta forests and dried up what was once a vast, braided network of river channels, marshes, lagoons and estuaries that were nurseries for fish.

To bring more water to the delta, the U.S. and Mexico signed Minute 319, a five-year water agreement, in 2012. The agreement arranged for a “pulse flow” of 105,000 acre-feet to be delivered to the delta over an eight-week period in 2014 (Congressional Research Service 2017). The natural flooding conditions simulated by the pulse regenerated stands of cottonwood and willows, increasing the diversity and abundance of birds (Flessa, Kendy and Schlatter 2016).

“If one partner chooses to wall-off its landscape and isolate itself, we all lose. Though our personal friendships will last, the institutional ties and the physical corridors on the land will suffer.”

—*Juan Carlos Bravo, Mexico Program Director
Wildlands Network*

In 2017, the partners negotiated a second agreement, Minute 323, which extends many of the previous agreement’s provisions for another nine years (James 2017). Like the 2012 agreement, Minute 323 commits freshwater to the delta and pledges restoration of estuaries and riverside habitats—1,076 acres in the 2012 agreement, an additional 3,224 in 2017 (International Boundary and Water Commission 2017).

Karen Schlatter, manager of the Sonoran Institute’s Restoration and Monitoring Program, started working in the Colorado River Delta in 2010 as “part of a tiny team implementing small-scale demonstration projects.” Today the institute leads projects in the delta



To restore water flows and habitat in the Colorado River Delta, government agencies, conservation groups and local citizens in the United States and Mexico are working closely together.



BOTH PHOTOS © WALT CLARK

Vehicle barriers (top) completed on the border in Buenos Aires National Wildlife Refuge in 2007 effectively curtailed entries by vehicle and left the border permeable to most wildlife movement. Less than six months later, a U.S. Customs and Border Protection plan to replace the barriers with a 15-foot, bollard-style steel wall moved forward after a hasty environmental assessment claiming “no significant impact” and an equally rushed Section 7 consultation (for impacts to endangered species). By September 2007, the refuge had severely damaged habitat and an impenetrable 7.6-mile-long section of border wall (bottom).

with help from local communities. The “scaled-up” delta program now has “more than 20 people, and we’re collaborating with diverse organizations across the border,” she says (Schlatter 2017).

Locals hired when the program first started have become experts in restoration and ecosystem monitoring and risen in the ranks. Mexican national and former hunting guide Guadalupe Fonseca is now the institute’s field chief, overseeing the restoration crew on the ground. “I was here for the 2014 pulse flow,” he says. “It was wonderful to witness the river meet the sea for the first time in many years. There was so much joy... people celebrating and playing in the water.

Now everyone wants to know when the next pulse will be (Fonseca 2017).”

Some of Fonseca’s staff used to commute an hour and a half each way to work in Mexicali’s factories. Today they work outside at restoration sites only 10 minutes from their homes. People who used to sell fence posts cut from the forests now work with pride to restore and study the forests they used to exploit (Fonseca 2017) and they are seeing the results of their efforts. “Not only are we seeing birds and other wildlife return to restored native habitat, but the positive impacts of restoration for local small communities in Mexico is incredible to witness,” says the Sonoran Institute’s Schlatter (Schlatter 2017).

The looming threat of the wall

Conservationists and scientists are not the only ones who recognize the impact an expanding border wall and its security operations footprint would have on wildlife and habitat in the Sonoran Desert—and on long-standing collaborations among nongovernmental organizations and government agencies in the United States and Mexico. Local governments that depend on tourism and other benefits that flow from a healthy environment are worried, too.

In 2011, Pima County unanimously passed a resolution opposing the waiver of environmental laws on public lands for Border Patrol operations within 100 miles of the U.S.-Mexico (Pima County 2011). In 2017, the county passed a resolution denouncing President Trump’s executive order mandating border wall construction, stating, “the existing border structures have caused substantial environmental damage, including catastrophic floods, erosion, degradation of public lands and facilities, blockage of normal wildlife migration corridors, and destruction of critical wildlife habitat, all of which has contributed to harm of hundreds of border-region species...” (Pima County 2017).

“We are working to protect 44 unique local species, nine endangered or threatened, with the Sonoran Desert Conservation Plan,” says Pima County Supervisor Richard Elias, a fifth-generation Tucsonan and wildlife advocate. “A border wall degrades their habitat and cuts off corridors they need to get from one place to another” (Elias 2017).

One sensitive area on the border, Buenos Aires National Wildlife Refuge, already has a section of wall—seven miles constructed in 2007. Defenders of Wildlife helped convince the refuge manager to veto construction of the segment,

but the wall was ultimately built when FWS gave up a strip of refuge land along the border in exchange for land elsewhere to be provided by U.S. Customs and Border Protection.

Building more wall in the Sonoran Desert would exacerbate existing threats and pose new ones.

Blocked wildlife movement.

According to a 2009 study, bighorn sheep in Sonora, Mexico, are linked by dispersal with bighorns in neighboring Arizona. Impermeable walls would prevent genetic exchange and stop sheep from reaching resources they need on the other side of the border (Flesch et al 2010).

Cactus ferruginous pygmy-owls typically fly an average of 4.5 feet above ground and avoid large clearings and developed areas. An insurmountable border wall and adjacent roads could fragment populations, hindering dispersal into the United States from northern Sonora and handicapping recovery of the owl (Flesch et al 2010).

The endangered Sonoran pronghorn must travel across the desert to find the nutritious forbs required for successful reproduction. Any physical barriers impeding pronghorn movements in the areas where they are active (Figure 5) can be deadly, especially during times of drought (FWS 2013a). “If a solid border barrier is built,” says Miguel Angel Grageda of El Pinacate, “genetic links would be severed. It would then be up to humans to capture and move pronghorn to maintain genetic flow, which would be expensive and risky for the animals.”

Loss of habitat. Animals may go out of their way to avoid the impact zone—the areas extending far beyond the

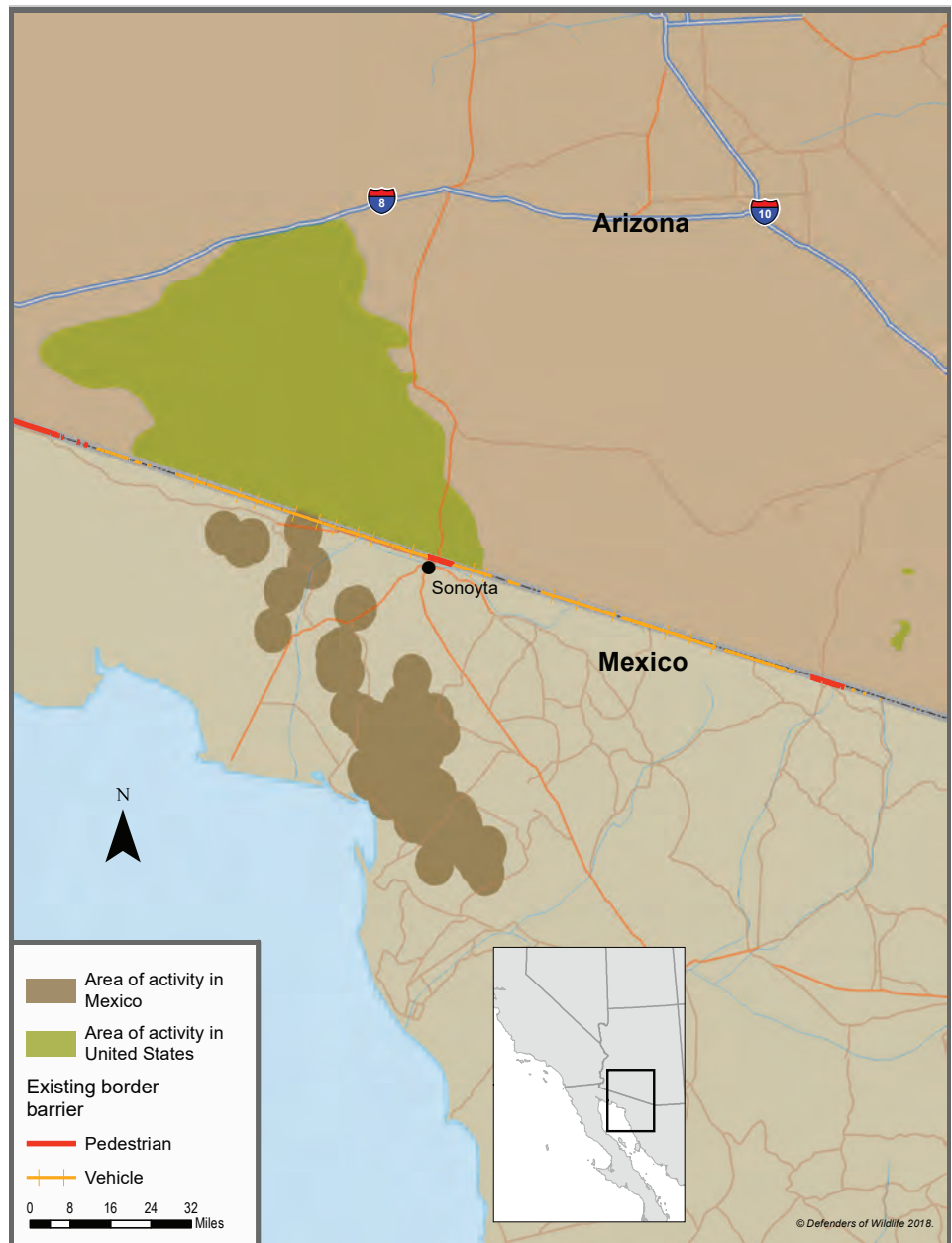


Figure 5. Areas of Sonoran pronghorn activity

physical border wall, where traffic, lights, noise and human activity disturb sensitive wildlife and habitat. A growing network of patrol roads, operating bases, surveillance towers and maintenance facilities results in significant cumulative impacts. A 2014 NPS study mapped approximately 9,327 miles of undesignated vehicle routes in the vicinity of the Border Patrol’s Ajo-1—a 10-tower surveillance project. The study revealed a maze of tracks harming soils, plants and sensitive wildlife on and near Cabeza Prieta National Wildlife Refuge and Organ Pipe Cactus National Monument (Howard, Rutman and Stum 2014).



© SCOTT NICOL

Organ Pipe Cactus National Monument shows the erosion caused by torrents of water redirected when heavy rains trap debris against a border wall.

Flooding. Sections of the border wall already built exacerbate flash flooding caused by rainy-season downpours. Even when openings are provided to let water through, the wall acts like a clogged sieve, trapping debris that dams and redirects floodwaters. Such events damaged habitat in Organ Pipe Cactus National Monument, caused millions of dollars in property damage in Nogales, Mexico, and even toppled a section of the border wall (McCombs 2008, NPS 2008).

Hurdle to binational cooperation. Juan Carlos Bravo, who works for the Wildlands Network in Hermosillo, Mexico, warns that border militarization and walls counter decades of binational investment in conserving the large landscapes required to sustain wide-ranging species. “For decades, Mexican and U.S. agencies, nonprofits and individuals have worked together to conserve shared species and habitats, bringing down cultural and language barriers in the pursuit of a higher ideal—that the land we all love and the species

we all care for may still be here for generations to come. If one partner chooses to wall-off its landscape and isolate itself, we all lose. Though our personal friendships will last, the institutional ties and the physical corridors on the land will suffer” (Bravo 2017b).

The Tohono O’odham Nation, a Native American tribe, governs 2.7 million acres spanning the border in Arizona and Sonora, Mexico. Jose Martin Garcia Lewis, governor general of the tribe in Mexico, says the proposed border wall would destroy his tribe’s way of life, despoil their land and violate their tribal sovereignty, “It will deny our shared cultural and religious practice in the Pinacate: our Salt Ceremony and Pilgrimage, our collection of medicinal plants, visitation to burial sites and sacred cave sites, and plant life. It will, under international law, illegally sever our communications with and access to the Tohono O’odham Nation in Arizona” (Náñez 2017).

Borderlands Conservation Hotspot

3. Sky Islands



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The Sky Islands, also known as the Madrean Archipelago, is a unique landscape of mountains and grasslands globally recognized for its biodiversity.

Forested mountain ranges rise from desert grasslands like towering islands in a sea. This is the aptly named Sky Islands, a globally unique region where temperate and subtropical zones, the Chihuahuan and Sonoran deserts and conservation-minded Mexicans and Americans come together. Successful conservation here often requires cross-border collaboration, but with all the talk of the wall, a shift is occurring. “The current political reality has complicated cooperation,” says Mirna Manteca, a biologist with the nonprofit Sky Islands Alliance.

The bioregional convergences and changes in temperature and precipitation from desert floor to mountaintop endow the Sky Islands with a biological diversity that is among the richest in the world. In this region of 47,000 square miles extending north from the Mexican states of Sonora and Chihuahua into southern Arizona and New Mexico, the tropical and temperate zones meet. The ranges of jaguars and military macaws overlap those of black bears and bald eagles.

The region’s patchwork of protected public and private lands is an investment in its natural endowment. Creosote scrublands, stands of saguaro and organ pipe cactuses, mesquite forests and some of the last best natural grasslands in the Southwest characterize the Sky Islands flatlands.

Broadleaf forests prevail higher up the mountains, with mixed conifers reminiscent of Canada at the top.

Streams running from the mountains join to become rivers like the San Pedro, which flows north from Mexico into Arizona near Sierra Vista. A ribbon of green winding through the arid land, the San Pedro is one of the last undammed rivers in the Southwest (Webb, Leake and Turner 2007) and one of the most important migratory bird flyways in the region (San Pedro River Ecology 2017). The river corridor shelters 300 species of birds (U.S. Fish and Wildlife Service [FWS] 2012a), 200 species of butterflies and 20 species of bats as they fly from Central America and South America and back (Arizona Important Bird Area Program 2017). The river sustains the

WILDLIFE AND HABITAT ON THE LINE

Land managers and conservationists have their work cut out for them in the Sky Islands. The southern Arizona portion, which encompasses the city of Tucson, is part of the Arizona Sun Corridor. This corridor is one of the fastest growing parts of the United States, bringing sprawl and roads that destroy and fragment habitat. U.S. Interstates I-10 and I-40 are formidable barriers for jaguars and other mammals traveling north. In Mexico near the border, east-west Highway 2, running parallel to the border, is undergoing a major upgrade that will make it less passable for wildlife in places without wildlife overpasses or underpasses.

Throughout the Sky Islands, logging, grazing, transmission lines, mining and water extraction degrade habitat. Off-road vehicles damage soil that can take decades to recover (Abella 2010). Fire suppression allows scrub to invade grasslands, displacing pronghorn, burrowing owls and prairie dogs. Habitat destruction in the biologically rich Sky Islands has landed about 40 species found in Arizona and Sonora on either the U.S. or Mexican endangered species list or both (Fernandez et al 2009). Appropriation of water and introduction of green sunfish and other exotics has left 20 of 35 surviving native fishes in Arizona federally threatened or endangered (Arizona Game and Fish Department [AGFD] 2017). Loss of riparian forest helped put the western yellow-billed cuckoo and southwest willow flycatcher on the

largest intact mesquite bosque (forest) in Arizona (Audubon Society 2017), an area that harbors 40 percent of the Arizona nests of endangered Southwestern willow flycatcher (Audubon Society 2017). In places the San Pedro and its tributaries have dwindled or run dry, their waters diverted for agriculture, industry and households, but the stretches that still flow are havens for endangered fish, frogs, water snakes and as many as 84 mammal species (Sonoran Institute 2018).

Although some border fencing is already in place in the Sky Islands, key cross-border wildlife passages remain open—for now—and jaguars, an extirpated U.S. endangered species, are entering the United States from Mexico.



© BOB SHIRRAUGH

endangered species list (Daw 2013; Daw 2014).

Studies show that top predators like mountain lions, wolves and jaguars are essential to maintaining healthy ecosystems. In the Sky Islands, mountain lions are under intense hunting pressure. Trail-camera monitoring indicates a marked decrease in their borderlands numbers over the last decade. (Malusa 2018).

A hunter shot the last female jaguar in the United States in 1963 (Brown, Lopez Gonzalez 2001), but male jaguars from a population in Sonoran, 120 miles into Mexico, are now venturing over the border. FWS released a draft recovery plan, but it has no provision for protecting potentially vital movement corridors (Peters 2017).

FWS reintroduced Mexican gray wolves, which had been extirpated from the United States by the middle of the 20th century. But the latest recovery plan for the species restricts them from moving into millions of acres of suitable habitat and does not allow for the connectivity necessary for healthy, sustainable populations.

Conservation lands

Recognizing the biological importance of the Sky Islands, agencies, nonprofit groups and individuals in the United States and Mexico have made monumental, complementary investments in conservation lands (Figure 6).

In southeastern Arizona and the southwestern corner of New Mexico know as the “bootheel,” a complex of U.S. and Mexican protected areas sandwich more than 60 miles of border, allowing bison, bighorn sheep and other wildlife to move back and forth. The conservation lands on the U.S. side include the private Diamond A Ranch, San Bernardino National Wildlife Refuge and 1,052 square miles of wilderness

and wilderness study areas.

Mexico has 203 square miles acquired and protected by Cuenca Los Ojos, a private foundation, and the huge (2,032 square miles) federal Janos Biosphere Reserve. The Janos reserve boasts one of largest remaining prairie dog colony complexes in the world (Sierra-Corona et al 2015) and reintroduced endangered black-footed ferrets that rely on the prairie dogs and their burrows for food and shelter (Ceballos et al 2010).

Some 80 miles to the west is another complex of protected lands with several U.S. natural areas and wildernesses. The complex includes Buenos Aires National Wildlife Refuge and the San Pedro Riparian National Conservation Area, which protects 40 miles of the San Pedro River running north from the border.

On the Mexican side the private Rancho Los Fresnos reserve is managed by the nonprofit Naturalia to protect the largest remaining group of *ciénegas* (springs and wetlands) in the San Pedro River watershed (Smith 2017). Beaver reintroduced in the U.S. portion of the Lower San Pedro River found their way across the border to Rancho Los Fresnos (Smith 2017), where the dams of these once extirpated rodents retain water that soaks into the ground, raising water tables and nurturing trees and smaller plants (New Mexico Department of Fish and Game 2017).

Also in this complex is Las Cienegas National Conservation Area, 70 square miles of rolling grasslands, oak-studded hills and *ciénegas*—the marshes that give it its name. This area managed by the Bureau of Land Management (BLM) bridges the Santa Rita and Whetstone mountains and shelters American pronghorn, endangered western willow flycatchers,

northern Mexican garter snakes, Sonoran leopard frogs and Gila top minnows and other endangered fishes (Bodner and Sims 2008; FWS 2014b).

AGFD is re-establishing black-tailed prairie dog colonies in the valley’s grasslands (AGFD 2018), and the Frog Conservation Project is enhancing habitat to re-establish endangered Chiricahua leopard frogs throughout the valley (Frog Conservation Project 2018). The nonprofit Cienega Watershed Partnership works with the BLM, Bureau of Reclamation, Pima County and valley land owners to restore habitat and engages youth in hands-on restoration

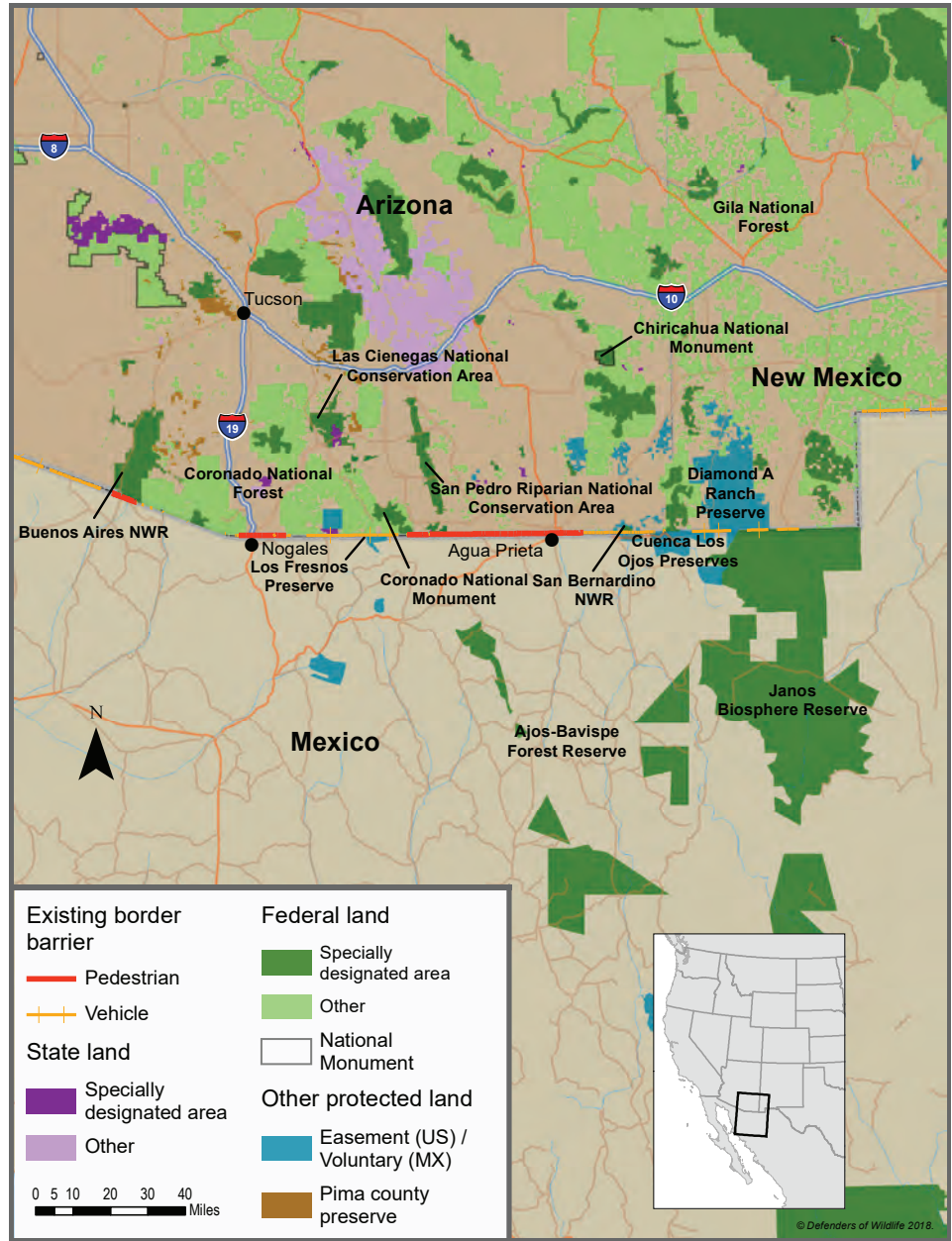


Figure 6. Protected areas in the Sky Islands



BLM-managed Las Cienegas National Conservation Area encompasses grasslands, hills and cienegas—the spring-fed marshes that give it its name.

and research through its YES! Program (Cienega Watershed Partnership 2018).

Conservation collaborations

Meaningful conservation in the Sky Islands requires close cooperation between the United States and Mexico, in part because both countries are interested in restoring important predators like Mexican gray wolves in the United States and black-footed ferrets in Mexico. Binational efforts are underway to restore populations of predators and other species and to improve habitat management, research and training.

Restoring species

U.S. and Mexican wildlife agencies have established two small populations of Mexican gray wolves, one in Arizona and New Mexico and one in Chihuahua; long-range plans are for the two populations to converge. Last year at least two wolves from Mexico briefly crossed into the United States (Miller 2017). Agencies involved with Mexican gray wolf restoration include AGFD, FWS, U.S. Forest Service and Wildlife

Services, White Mountain Apache Tribe and Comisión Nacional de Áreas Naturales Protegidas (CONANP).

In 2013, the National Park Service (NPS), The Nature Conservancy and a coalition of Mexican partners reintroduced bison in the Janos Biosphere Reserve as part of a long-range plan to restore grasslands (Nature 2009). A second group of bison, the Janos-Hidalgo herd, travels freely back and forth across the border between Chihuahua and private ranchland in New Mexico (List 2017).

Some species are recolonizing on their own. A Mexican population of endangered black-tailed prairie dogs expanded across the border into the southwest corner of New Mexico, an area where poisoning had eradicated them (List 2007).

Other species-focused collaborations include a multi-million dollar project run by the University of Arizona that monitors jaguars and other border cats with trail cameras (University of Arizona 2017) and efforts by the FWS Mexico Program in Arizona, Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) and other partners to protect wildlife in Sonora, Mexico, including imperiled

DEFENDING JAGUAR COUNTRY

Gooch Goodwin grew up in a ranching family with a father who was a renowned big cat hunter and a conservationist grandfather who believed even the maligned coyote had a place in the borderlands he ranched.

Right out of high school Goodwin started working for Animal Damage Control (now Wildlife Services), the arm of the U.S. Department of Agriculture charged with predator control, but the conservation ethic instilled by his grandfather soon took hold. He took a job as a fire lookout on an isolated mountaintop and became the environmental activist and jaguar advocate he is today.

Goodwin's family ranched in the Patagonia area, south of Tucson, where Mexican gray wolves still roamed when he was a boy. He also remembers his father killing a jaguar (before the U.S. population was protected under the Endangered Species Act) and hanging its hide on a wall at home.

Hoping to see jaguars—and wolves—back in the Sky Islands, Goodwin and his wife, Wendy Russell, joined with neighbors to form the Patagonia Area Resource Alliance. The group monitors the water flowing from abandoned mines and documents the presence of rare species like endangered Mexican spotted owls. With help from Defenders, the alliance stopped a mining

species like the longfin dace, red-spotted toad, flat-tailed horned lizard, masked bobwhite, cactus ferruginous pygmy-owl and Sonoran pronghorn. (Fernandez et al 2009).

Protecting habitat

“If we don't collaborate, we will keep losing populations, impoverishing the borderlands regions from a biological perspective” says Rurik List, ecology professor at the Universidad Autónoma Metropolitana-Lerma (List 2017). List started working with U.S. and Mexican partners in the early 1990s. He helped organize conservationists and scientists from both sides of the border to plan a United States to Mexico network of connected reserves. The Sky Island Alliance teamed up with partners to identify priority hotspots for conservation, including the area around Janos, Chihuahua, which is critical for bears, eagles and bison. Mexico



COURTESY OF GOOCH GOODWIN

Activists Gooch Goodwin and Wendy Russell

exploration project in critical borderlands habitat for jaguars. But Goodwin is worried. “If the wall is built,” he says, “it's all over for the jaguar in the United States.”

subsequently designated the area as biosphere reserve.

Mexico's Ajos-Bavispe Forest Reserve collaborates on bird monitoring, fire management research and environmental education with its official U.S. sister parks, the Chiricuhua and Coronado national monuments, managed by the National Park Service (NPS 2017a). With assistance from the Sky Islands Alliance, Coronado National Monument staff trained staff at Naturalia's Los Fresnos reserve just across the border on erosion and invasive species control.

Rallying ranchers

Knowing that ranchers are key to conservation in the borderlands, Rodrigo Sierra, a conservation biologist with Universidad Nacional Autónoma de México (UNAM), started raising cattle himself. “I had to know what I was talking about,” he says (Sierra 2017). He now has good



relationships with Janos ranchers, helping them develop sustainable grazing plans and restore wildlife habitat, which complements his work on recovering pronghorn, bison and prairie dogs in the Janos Biosphere Reserve. His research has already shown that well-managed prairie dog colonies improve forage for cattle.

Mexican researcher List made friends with ranchers in the Malpai Borderlands Group, Arizona landowners who want to manage their property well and preserve open space. Warner Glenn, a founding member of the group, has been a vocal champion of jaguars since the “God Almighty! That’s a jaguar!” moment he had in 1996 when he was hunting in the Peloncillo Mountains of the Sky Islands in Arizona and his hounds cornered a male jaguar (Gross 2015). Today, Warner and the other members of the Malpai group hold conservation easements on 78,000 acres on 15 ranches and cooperate with landowners across the border in Mexico (McDonald 2017, Barry 2017). These landowners use prescribed burning to restore grasslands and have constructed thousands of small check dams in gullies to retain water and restore vegetation in the San Bernardino Valley for jaguars, leopard frogs, long-nosed bats and ridge-nosed rattlesnakes (McDonald 2017).

A land-managing foundation

Conservation-minded Valer Clark and Josiah Austin set up a private foundation, Cuenca de Los Ojos, to conserve and restore land. They bought 25,000 acres eaten to bare dirt by cattle and proceeded to turn it around. So far, the foundation has re-seeded more than 5,000 acres of grassland, restored at least 15 percent of historical wetlands and returned year-round flows to six miles of once-dry rivers (Cuenca de Los Ojos 2017). On the U.S. side of the border, the foundation works on projects with the Arizona Malpai Borderlands Group and coordinates land management with adjacent San Bernardino National Wildlife Refuge. The refuge was created to recover endangered fishes in the Rio Yaqui Basin, including the Yaqui catfish, which no longer survive in natural populations in the United States because of water diversion and cattle grazing and is barely holding on in Mexico (NatureServe 2013).

In December 2017, Cuenca los Ojos hosted a meeting with World Wildlife Fund-Mexico that brought together some of the main players in the conservation of northern Mexico, including Universidad Nacional Autonoma de Mexico, The Nature Conservancy, Bird Conservancy of the Rockies, CONANP, Naturalia and PROFAUNA. Together they

“If we don’t collaborate we will keep losing populations, impoverishing the borderlands regions from a biological perspective.”

—*Rurik List, ecology professor at the Universidad Autónoma Metropolitana-Lerma*

developed objectives for protecting Chihuahuan grasslands (Sierra 2017).

The looming threat of the wall

Of the 362 miles Arizona shares with Mexico, 124 miles already have tall wall segments designed to exclude pedestrians. Another 183 miles have vehicle barriers, leaving only 55 miles of the Arizona-Mexico border with no barriers at all (U.S. Customs and Border Protection 2017). According to news reports based on an internal agency document, the Department of Homeland Security (DHS) plans 151 miles of new or improved barriers in Arizona (Carranza 2017).

Blocked wildlife movement. The best bet for long-term survival of jaguars and Mexican gray wolves in the Southwest is connecting U.S. and Mexican populations. Jaguars are now crossing from Mexico into Arizona through the mountains in areas with no wall or possibly places with just vehicle barriers (Figure 7). The flood plain where the San Pedro River flows north from Mexico is already bisected by pedestrian wall, and the river bed itself has Normandy-style vehicle barriers that are removed during the monsoon season to keep them from washing away. Robert Weissler, president of the Friends of the San Pedro, believes jaguars can enter the United States through gaps in these barriers, coming up the river and following one of its washes up into the mountains. “So you build a wall and obviously large critters like jaguars are going to be excluded,” he says. (Dayton 2017) This includes ocelots, also occasionally seen in the Sky Islands borderlands.

As for Mexican gray wolves, scientists conclude that a healthy population should number at least 750, seven times more than currently in the U.S. wilds (Defenders et al 2014). An additional 30 some wolves live in Mexico not far from the border. In 2017, two of them, a male and female, crossed briefly into Arizona and New Mexico (Miller 2017). Fortunately, there are still large expanses of potential habitat for wolves on federal and tribal lands

“If the wall is built, it’s all over for the jaguar in the United States.”

—Gooch Goodwin, *Patagonia Area Resource Alliance*

in the Sky Islands landscape, including the Gila and Coronado national forests (Peters 2017).

The ultimate recovery vision is to connect these Mexican and U.S. wolves via protected corridors. Completing the wall would preclude this possibility, undercutting millions of dollars already spent on wolf recovery in both countries.

Even some relatively common animals like coatis are disturbed by the wall—a 2011 study found lower densities of mountain lions and coatis in border areas near wall segments (Evans Ogden 2017). The wall would also disrupt a cross-border population of black bears. A 2011 genetic study showed that black bears in southern Arizona are more closely related to Mexican bears than to bears in central Arizona (Atwood et al 2011). These border bears are a single population, and completion of a border wall would split it in two.

Some birds also could be blocked. A study of the imperiled cactus ferruginous pygmy-owl, scattered in remnant populations that have woodlands and saguaro cactuses, concluded that it would be unlikely to cross the wall because it flies so low to the ground (Flesch and Steidl 2007, Flesch et al 2010, Evans 2017).

Hurdle to binational cooperation. Existing border barriers and associated militarization already make conservation more difficult. Rurik List says that 15 years ago Mexican conservation staff and scientists could cross the border from

Janos to visit neighboring U.S. ranches without much trouble, but it has become more difficult. “Now it’s hard to monitor effects of the border wall directly,” says List. According to Sky Islands Alliance biologist Mirna Manteca, “U.S. National Park Service staff can’t easily visit the Mexican parks, and it’s hard for Mexican officials to come to the U.S. for training, making these long-term cooperative projects difficult.” But she is optimistic about one thing: “There’s lots of interest in partnering up and uniting against the wall,” she says” (Manteca 2017).

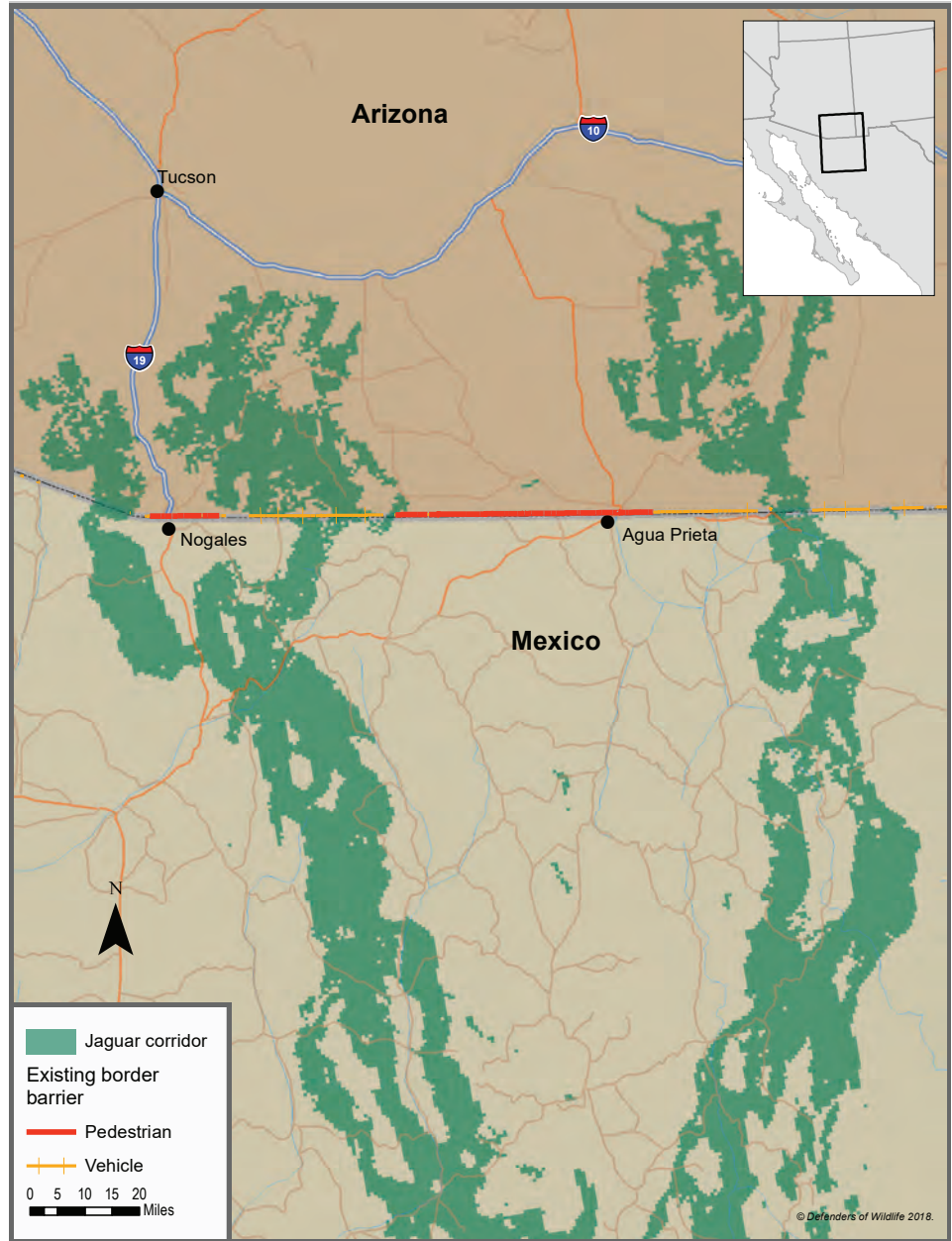


Figure 7. Potential jaguar connectivity in the Sky Islands



JIM CLARK/FWS

Completing the border wall would undercut the millions of dollars already invested in Mexican gray wolf recovery by the United States and Mexico.

Diversion of funds. Money spent on the wall is money not spent on conservation. The National Fish and Wildlife Foundation (NFWF) estimates that it would cost \$265 million to restore populations of key species like black-tailed prairie dogs and the grasslands, wetlands and other habitat they need in the U.S. and Mexican Sky Island landscape (NFWF 2009). That is roughly the cost of building 10 miles of border wall at \$25 million per mile.

Undercutting conservation investments. As documented in the previous section on conservation collaborations, agencies, nonprofits and private citizens have significant investments in Sky Island conservation that the wall could jeopardize. Existing sections of wall already cut through the Lower San Pedro Valley, where more than 50 million dollars has been invested to protect over 200,000 acres (Tucson Audubon 2015). The Sky Islands Restoration Cooperative spent \$2,874,000 on restoration projects in 2015 and valued volunteer contributions at a minimum of \$191,000 (Sky Island Restoration Cooperative 2015).

Impact on ecotourism and aesthetic values. The wall could decrease income generated by ecotourism and the natural

amenities that draw people to live and recreate in scenic, biologically rich places. Over the last half century, the Sky Islands town of Patagonia shifted from mining to ecotourism with an increase in sales tax revenue of 364 percent, corrected for inflation (Shafer 2014). “Eighty-five percent of our business is from visitors to the Patagonia Mountains who come here to enjoy birding, hunting, camping, cycling, hiking and other outdoor recreational activities,” says Carolyn Shafer, owner of an art gallery in Patagonia (Shafer 2014). Only 15 miles from the border, the town is likely to take an economic hit if the wall and intimidating border security activities keep tourists away.

According to a 2012 study, within two years of opening a border checkpoint on Interstate 19 significantly depressed real estate values in the tourism-dependent communities of Rio Rico and Tubac, Arizona, located just south of the checkpoint, compared with communities north of the checkpoint. Although more difficult to quantify, the study reported that “business representatives to the south of the checkpoint were unequivocal in their views that there has been, in fact, a decline in tourism in the region as a result of the checkpoint (Gans 2012).”

Borderlands Conservation Hotspot

4. Big Bend



COOKIE BALLOU/NPS

Rio Grande Vista and Crown Mountain, Big Bend National Park

The Rio Grande changes course between southwestern Texas and the Mexican states of Chihuahua and Coahuila, making the turn from southeast to northeast that gives the surrounding borderlands region its name, Big Bend. Big conservation success stories unfold here as researchers, biologists, land managers and volunteers on both sides of the border work together. Bringing the wall to Big Bend threatens to end these stories and the binational cooperation behind them—“25 to 30 years of confidence building and capacity building,” as researcher Gary Nabhan describes it (Nabhan 2018).

Big Bend already has some imposing natural walls, 1,500-foot canyon faces carved by the river in its path along its turn through the fragile Chihuahuan Desert. Like the Sonoran Desert, the 250,000-square-mile Chihuahuan is dotted with the isolated mountains known as sky islands, but it is a dryer, higher, cooler desert with an even greater biological diversity than the Sonoran. In fact, the Chihuahuan is one of the most biologically diverse deserts in the world (Pronatura Noreste et al 2004), home to 446 species of birds, 3,600 species of insects, 75 species of mammals and more than 1,500 plant species (U.S. Department of the Interior 2011).

The Big Bend region of the desert is remote—the area around Big Bend National Park has so little human

settlement that light pollution is negligible. According to the International Dark Sky Association, it is one of the best places in the world to see stars (National Park Service [NPS] 2012a).

At the moment, the Big Bend region has no border wall segments and very little fencing, but it is on the Department of Homeland Security (DHS) list for new barrier-building in Texas.

Conservation lands

The Big Bend region has 4,687-square miles of protected areas, including Big Bend National Park, Big Bend Ranch State Park and Black Gap Texas Wildlife Management Area in the United States and, in Mexico, reserves managed

BIG CHALLENGES

Big Bend faces conservation challenges as expansive as the landscape itself.

Despite relatively small human populations, the fragile Chihuahuan desert on both sides of the border in the region shows the damage of more than 150 years of overgrazing, logging and other resource extraction. In the high forests of the Maderas del Carmen of Mexico, logging operations began in the 1920s and continued on a large scale until the late 1960s (McKinney and Villalobos 2004). The landscape also bears the scars of mining for lead, silver and fluorspar.

Over large areas native grasses are gone, lost to overgrazing and replaced by sparse shrubs or bare ground with an impenetrable crust. Infrequent but heavy desert rains run off without soaking into the soil, eroding the land and making it impossible for native plants to re-establish (Rinas 2018). One endangered perennial grass, the Guadalupe fescue, has only two known surviving populations, one in the Chisos Mountains within Big Bend National Park and a second in the Maderas del Carmen mountains (NPS 2017b).

Development and water withdrawal have diminished and degraded the bosques (forests) along the Rio Grande (Hoyt 2002), imperiling forest-dependent species like western yellow-billed cuckoos and southwestern



Southwestern willow flycatcher

willow flycatchers (Hunter et al 1987) and likely causing the loss of the once-dominant screwbean mesquite tree from 50 percent of the places it was found a century ago (Foldi 2014). Cottonwoods and willows have vanished from much of Big Bend because the over-managed river no longer floods and wets the soil so seeds can germinate (Lovell, Gibson and Heshcel 2008).

As in other border regions, predators and game species like pronghorn and bighorn sheep were nearly wiped out at the hands of humans. Once common, jaguars were killed off in Texas by the 1940s (Brown and Lopez Gonzalez 2001; Sinclair 2008). Black bears disappeared from the Texas side of the Rio Grande in the 1950s but re-entered Big Bend National Park from Mexico in the late 1980s (NPS 2015a).

by Comisión Nacional de Áreas Naturales Protegidas (CONANP): Parque Nacional Cañon de Santa Elena, Área de Protección de Flora y Fauna Ocampo, and Maderas del Carmen Área de Protección de Flora y Fauna (Figure 8). Because of their global ecological importance, both Maderas del Carmen and Big Bend National Park have United-Nations-designated International Man and the Biosphere Reserve status.

Collectively, these reserves cover a large expanse of the Chihuahuan Desert and sky island mountains similar to those in the Sky Islands borderlands conservation hotspot. The Rio Grande itself is protected by U.S. Wild and Scenic River designation and by the Mexican Monumento Natural Rio Bravo del Norte.

Private landowners on both sides of the border are actively

engaged in land conservation. In 1985, the Hartes, a Texas newspaper family, donated 104 square miles of Chihuahuan desert grassland that became part of Big Bend National Park (Hevesi 2011). Although the Mexican government had designated Maderas del Carmen a protected area in 1994, it took a massive conservation investment by CEMEX, the global cement company, to ensure significant on-the-ground protection. In 2000, CEMEX began Proyecto El Carmen, an effort to purchase, protect and restore habitat that now covers 336 square miles (McKinney and Villalobos 2004).

A subsequent push by CEMEX and its conservation partners led to the 2005 designation of the land it owns adjacent to the border as the first wilderness in Latin America (Robles Gil 2006a). CEMEX is now working with Conservation International, Birdlife, and the WILD

Foundation on the El Carmen-Big Bend Conservation Corridor Initiative. The initiative is developing a wilderness management plan for the Sierra del Carmen Sky Island, roughly 781 square miles of private, corporate and government lands north and south of the border (Center for Biological Diversity [CBD] 2005).

Conservation collaborations

When President Franklin D. Roosevelt signed the legislation that established Big Bend National Park in 1944, he voiced his hope that it would one day be part of “one great international park” on both side of the Rio Grande (LoBello 2018). While no such physical designation yet exists, the vision of international cooperation in which it is rooted is flourishing in the region. The U.S. Department of the Interior (DOI) and Mexico’s Secretariat of the Environment signed a cooperative conservation agreement for the Big Bend area in 2011 (DOI 2011), and vigorous binational efforts are ongoing to restore habitat and wildlife and practice complementary land management.

Forming international alliances

Government agencies lead the Big Bend Conservation Cooperative, which has over 30 U.S. and Mexican partners, including the National Park Service (NPS), U.S. Fish and Wildlife Service, U.S. Geological Survey, Texas Parks and Wildlife; nongovernmental organizations like CONANP; World Wildlife Fund (WWF) and Profauna; Coca Cola and other companies; and universities like Utah State and Sul Ross State. Collective projects include the control of the

invasive tamarisk and giant river cane along the Rio Grande, reintroduction of the endangered Rio Grande silvery minnow, pronghorn and big horn sheep, and restoration of grassland, wetland, and riparian habitats on public and private lands (NPS 2012b).

The Greater Big Bend Coalition, an international member-based organization dedicated to protecting the region, supports restoration efforts and is developing momentum through a Change.org petition for realizing Roosevelt’s dream of establishing Big Bend International Park (Greater Big Bend Coalition 2017).

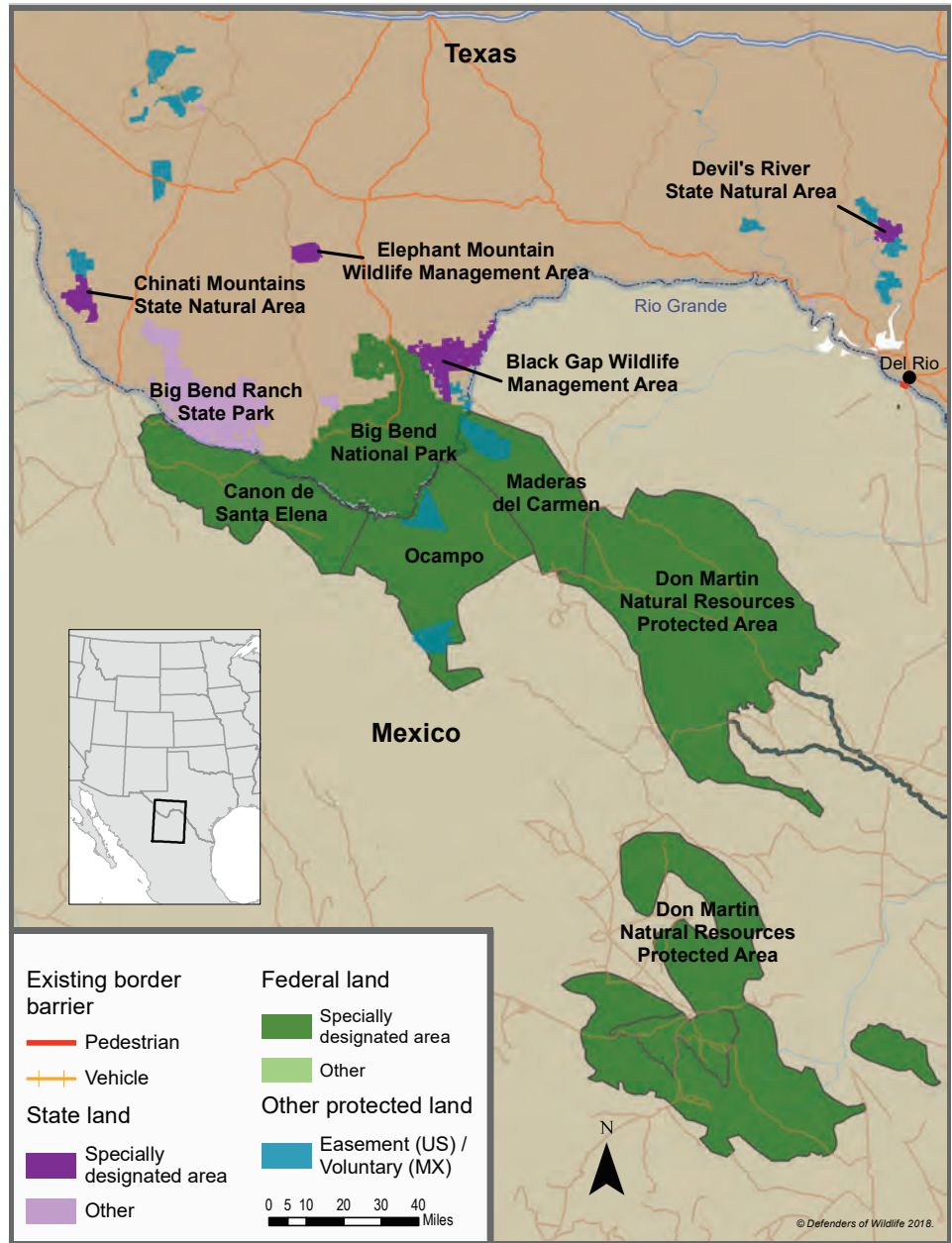


Figure 8. Protected areas in the Big Bend region



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A prescribed burn of giant cane, an invasive plant of no value to wildlife, continues into the night in Big Bend National Park.

Restoring grasslands

Conservation groups have been working with NPS since 2000 to restore the degraded Chihuahuan Desert grasslands in Big Bend National Park. Members of the Sierra Club and other groups—including volunteers from as far away as Washington state—are beginning to bring back grass cover on parts of this land eroded and devoid of plant cover after years overgrazing and water mismanagement (Brockmann 2014). According to Christina Rinas, a former park ranger at Big Bend, the volunteers gain work experience in resource management and restoration and “help keep our public lands in a healthy condition.” Similar restoration work is underway across the border at the Maderas del Carmen Biosphere Reserve, work that started with moving cattle off CEMEX land (Reynolds McKinney 2006).

Controlling invasive plants

In Big Bend National Park and elsewhere along the river dense stands of Asian tamarisk have replaced native willows and cottonwoods in the river’s flood zone. Tamarisk does provide habitat for some birds and other wildlife but supports fewer types of birds, reptiles, amphibians and insects than native tree communities (Shafroth et al 2005). Giant cane—with no food value for native wildlife—has formed dense monocultures along many banks, completely excluding native plants (NPS 2015b) and trapping silt, which builds up and narrows the river.

To combat these exotic plants, binational teams organized by the WWF Mexico Program, NPS, Profauna, Pronatura and CONANP cut, burn and apply herbicide on both banks of the Rio Grande (NPS 2014, 2016). With the successful use of tamarisk beetles from Asia to kill and reduce tamarisk groves on the river (Loomis 2017, Knutson, Mugge and Deloach 2015), efforts are focusing more on cane control (Briggs 2017). Mark Briggs, a conservation scientist and WWF program officer, says that although data is still being analyzed, “eradicating giant cane appears to be increasing riparian plant biodiversity, improving riparian and aquatic habitat, and making it easier for people to access and enjoy the river” (Briggs 2017).

Bringing back large mammals

At Maderas del Carmen, restored habitat and protection set the stage for growing populations of rare or previously extirpated wildlife, including Carmen Mountain mule deer, Rocky Mountain elk, pronghorn and black bear. In 2000, CEMEX, in cooperation with conservation organizations and wildlife agencies in Mexico and Texas, began breeding and releasing desert bighorn sheep, absent from Sierra del Carmen for more than 50 years (Reynolds McKinney 2006).

Ten years later, U.S. and Mexican wildlife agencies, including Secretaría del Medio Ambiente y Recursos Naturales (SEMARNAT, Mexico’s ministry for the environment) and the New Mexico Department of Game

and Fish, released New Mexican pronghorn. Entirely missing from the state of Coahuila since the 1950s, there are now more than 150 pronghorn in the Maderas del Carmen reserve (CEMEX 2016). Recent similar projects have reintroduced bighorn to Big Bend State Park, pronghorn within 40 miles of the border near Marfa, Texas, and mule deer to Black Gap Wildlife Management Area (Texas Parks and Wildlife 2018, 2016, Mule Deer Foundation 2016).

Patricio Robles Gil, founder of the Mexican conservation organizations Agrupacion Sierra Madre and Unidos para la Conservacion, helped CEMEX and its partners develop plans for bringing back the large mammals. He says, “Undoubtedly, we still face many challenges. But in this vast and remote wilderness, we can also find many opportunities to show that Texas and Mexico can be good neighbors and responsible stewards of the land and wildlife we all treasure (Robles Gil 2006b).”

Studying cross-border monarch migration

Every spring, imperiled monarchs fly from central Mexico and Texas to migrate north to Canada. In late summer and fall they return to Mexico. Most monarch migration maps do not include Big Bend as part of the migration corridor, but Gary Nabhan, a pollination ecologist who is part of a binational group of conservationists and scientists working to identify monarch migration routes and food sources, has verified ample evidence that the Big Bend region of Texas and the Sky Islands of Arizona are equally important because both have abundant milkweeds that flower at the right time to feed the monarchs.

“The resource management team at Big Bend National Park has been incredibly generous in supporting cross-border work just south of the border, where monarch breeding is highly probable,” says Nabhan (Nabhan 2018). In 2015 and 2016, NPS and other collaborating organizations trained staff from U.S. and Mexican agencies and nonprofits to identify areas where monarchs are breeding and to propagate and plant milkweed, the host plant for monarch larvae.

Solving Mexican long-nosed bat mysteries

Mexican long-nosed bats are endangered because overharvesting, agriculture and other human activities have wiped out wild agaves, their main food source in northern Mexico. But the lack of information on where these bats live, feed and migrate hinders conservation measures (Gomez 2017).

“Undoubtedly, we still face many challenges. But in this vast and remote wilderness, we can also find many opportunities to show that Texas and Mexico can be good neighbors and responsible stewards of the land and wildlife we all treasure.”

—*Patricio Robles Gil, founder, Agrupacion Sierra Madre and Unidos para la Conservacion*

Scientists surmise that the bats winter in Mexico in a handful of caves, and then many—mostly females—migrate, following the sequential north-to-south flowering of agaves until they reach Big Bend National Park, where they spend the summer.

A binational effort is underway to establish the basic natural history of these bats: How many are there? Where do they roost and bear their young? Where are the remaining patches of the agaves on which they depend? Researchers are solving these mysteries with a combination of old-fashioned fieldwork and modern high-tech. They capture bats in mist nets and fit each one with a passive integrated transponder (PIT) tag. The tag sends signals to an antenna at the mouth of a cave, providing the scientists with a record of each time a bat flies in and out of the cave. NPS provided a plane for aerial agave surveys in the mountains of the Maderas del Carmen Biosphere Reserve across the river from Big Bend National Park.

Bat researcher Emma Gomez and her team visit Mexican communities, informing them about bats, their roosting caves and the remote stands of agaves where they feed. “One of our local team leaders grew up near an important bat cave,” says Gomez. “He guided us to a cave near his community where we captured bats and was so excited to see them all up close.... Now he and other local community members guard the caves.”

Another bat expert, Mexican conservationist Rodrigo Medellin, works with the Tequila Interchange Project to convince tequila companies to allow 5 percent of their plantation agaves to flower naturally to provide nectar for the bats. The companies benefit because bats cross-pollinate the domesticated agaves with wild ones, adding genetic diversity to the domestic stock.

Some tequila brands now sport a bat-friendly label. In a *National Geographic* article Medellín describes the labeling program as “nothing short of a dream come true” that “will help save the bat and tequila at the same time.”

The looming threat of the wall

A 2017 DHS report called for construction of 151 miles of wall—as high as 30 feet—in Texas, including in Big Bend (Berrien 2017). Because most of state’s border is private land, which must be seized by eminent domain—a long and costly process, federal lands like Big Bend National Park are relatively easy places for DHS to build.

Changes in water flow patterns. Although the exact locations of possible Big Bend sections of the wall are unknown, the wall has caused flooding in other places, notably Organ Pipe Cactus National Monument and Nogales. Walls near the Rio Grande—or any river—can pose a danger to wildlife when animals get trapped against them by rising water and are unable to escape.

Conversely, habitat could be harmed if the wall *prevents* flood waters from reaching it. For example, willow and cottonwood trees, important habitat for imperiled species like yellow-billed cuckoos and southwestern willow flycatchers, require periodic flooding for their seedlings to establish.

Blocked wildlife movement. The Big Bend Conservation Cooperative and many others have invested huge amounts of work in restoring habitat and reintroducing animals like desert bighorn sheep, pronghorn, deer and bear. The goal for much of this work is the unimpeded cross-border movement of large mammals necessary to maintain connected, healthy populations on both sides. “Over recent decades, it’s been our goal to remove fences that block natural wildlife movement,” says Raymond Skiles, wildlife biologist at Big Bend National Park.

The importance of binational populations is clear from the story of Big Bend National Park’s black bears, absent from the park for decades before bears from Mexico moved north of the border to the park. According to Louis Harveson, director of the Borderlands Research Institute at Sul Ross State University, “If there’s a wall, West Texas would be out of the bear business.”

A more immediate threat from a future wall set back two or three miles from the river is the possibility of cutting off



© EMMA GÓMEZ

Jose Santos is one of the locals enlisted by bat researchers to protect caves where endangered Mexican long-nosed bats roost.

animals from the drinking water the river provides. “The Rio Grande is also the park’s most important water source for animals...it’s as simple as that,” says Big Bend biologist Skiles.

Reduced access for monitoring and management. Control of tamarisk and giant cane is a prime example of why easy access—unhindered by a wall—to both sides of the river is essential for managing habitat. These exotics infest both banks of the river and are currently treated by binational teams working either side with boats to control the two invasive plants.

Hurdle to international cooperation. Building border walls puts decades-long, cross-border cooperative projects—like managing stream flow and riparian vegetation, native fish and bighorn sheep and their habitats—and the relationships that support them at risk. “Managing only one side of a river is simply not possible,” says WWF’s Mark Briggs. “From planning to design to implementation, effective management of the Rio Grande/Rio Bravo requires active and equal participation from scientists, managers and riverside citizens from both countries” (Briggs 2018).

Diversion of resources. Monarch butterfly researcher Gary Nabhan points out that money spent on the wall is money urgently needed for conservation. “The agencies that do such work have already suffered budget cuts, and it seems like their international programs are targets for politicians who do not value cross-border work,” says Nabhan. Lack of resources and the political climate could undo 25 to 30 years of confidence building and capacity building in successful transborder collaborations.” (Nabhan 2018). Cuts in the United States coincide with recent substantial budget cuts in Mexico for the agencies supporting biodiversity like CONANP and the Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (De la Torre 2015).

Borderlands Conservation Hotspot 5. Lower Rio Grande Valley



© BRYAN BIRD/DEFENDERS OF WILDLIFE

Citizens protest the construction of a segment of border wall that would bisect Santa Ana National Wildlife Refuge and their own communities.

The Lower Rio Grande Valley has precious little protected public land but plenty of people passionate about conserving it. Hundreds of them joined hands in Santa Ana National Wildlife Refuge in August 2017 to protest pending plans for a border barrier that would cut right through this subtropical haven. “Putting the border wall in the Santa Ana would be like dropping a bomb on it,” says refuge volunteer Kurt Naville (Naville 2017), devastating for wildlife, habitat and binational conservation.

The Lower Rio Grande valley is 4,300 square miles of southern Texas sandwiched between the Chihuahuan Desert and the Gulf of Mexico. A convergence of temperate, desert, coastal and subtropical climate, a 365-day growing season and rich delta soils account for a diversity of plants (1,200 documented species) that attracts and supports a diversity of wildlife and makes the Lower Rio Grande a top nature tourism destination. The region’s species list includes 400 birds, 300 butterflies and imperiled species like sea turtles, ocelots, jaguarundis and Aplomado falcons.

The Lower Rio Grande lost most of its native thorn forest and wildlife habitat in the early 20th century when the land was cleared for agriculture. In the 1940s, seeking to save the last examples of subtropical riparian forest and coastal wetlands

in the state, the federal government began acquiring small tracts (Figures 9a, 9b). They were barely in the nick of time.

Conservation lands

One of the largest remaining riparian communities along the Rio Grande is in tiny Santa Ana National Wildlife Refuge (Raney et al 2003), 60 miles inland. Only three square miles, this refuge surrounded by cleared land is so unusual and beautiful that 165,000 people visit it annually (Jarvie and Bennett 2017), pumping \$35 million into the local economy (Mathis and Matisoff 2004). Visitors can see banded armadillos, Texas tortoises, Mexican free-tailed bats, 400 bird species and 300 species of butterflies—half the butterflies found in North America (U.S. Fish and

Wildlife Service [FWS] 2012b, 2012c). A more recent study found that nature tourism in the Lower Rio Grande Valley overall contributed \$463 million in 2011 (Woosnam et. al. 2012).

FWS manages two additional Rio Grande wildlife refuge units. The largest is 378-square-mile Laguna Atascosa National Wildlife Refuge, which borders the giant Laguna Madre coastal lagoon at the Rio Grande delta. The Laguna Madre extends across the border far into Mexico where it is part of the 2,212-square-mile Laguna Madre y Delta Del Río Bravo United Nations Educational, Scientific and Cultural Organization Flora and Fauna Protection Area, designated in 2005 (Figure 9b). This huge biosphere reserve protects an important migratory corridor for aquatic birds and birds of prey, stretching for some 220 miles along the Gulf Coast, approximately two miles wide in the south and 20 miles wide in the north (United Nations Educational, Scientific and Cultural Organization [UNESCO] 2011).

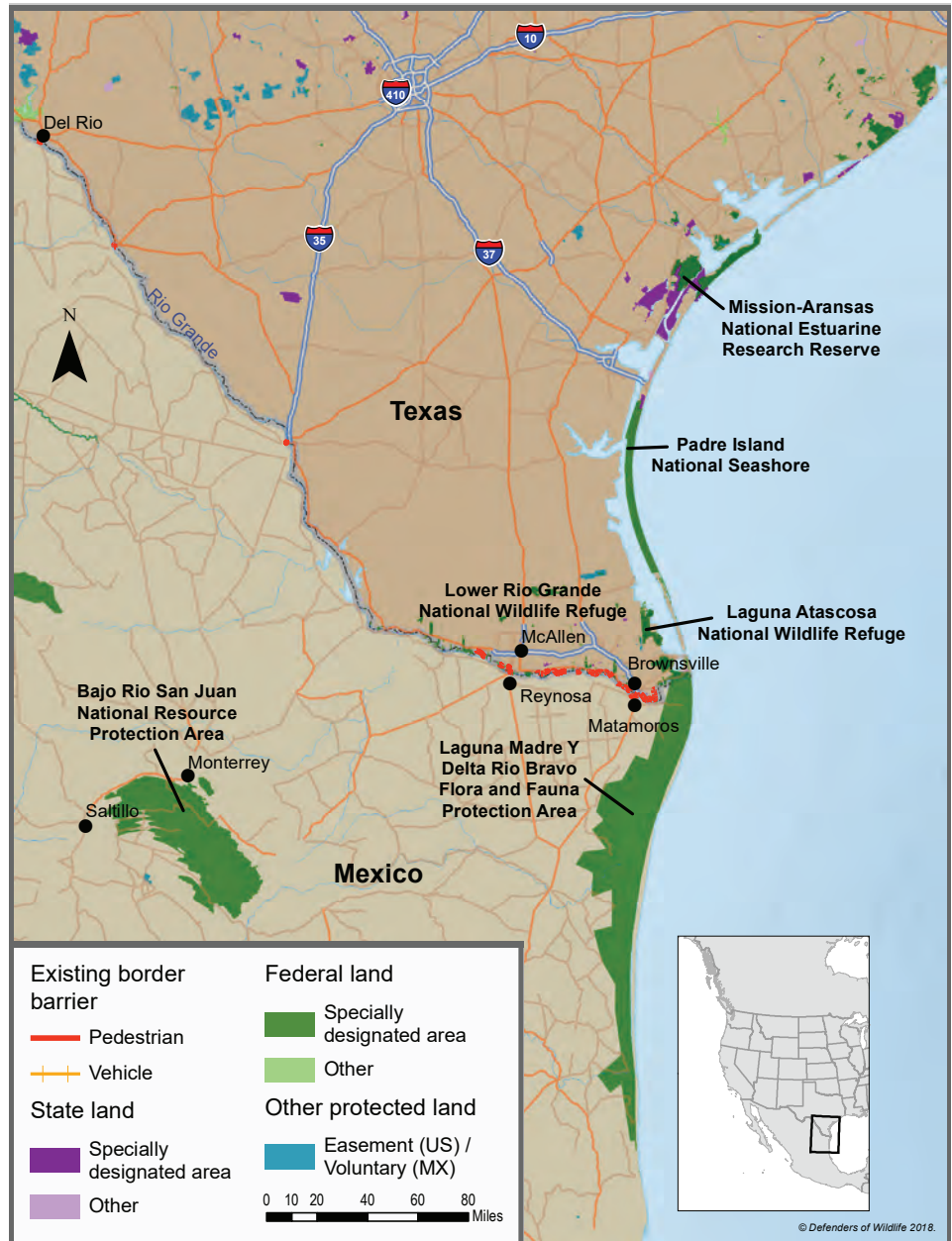


Figure 9a. Protected areas along the Lower Rio Grande

THEN AND NOW

One hundred and fifty years ago, jaguars and ocelots prowled the hundreds of thousands of acres of subtropical riparian forest that lined the banks of the Rio Grande (Brown and López González 2001). Then the clearcutting started. Today, less than 5 percent of this forest remains in the United States, 1 percent in Mexico (Environmental Protection Agency 2003). Jaguars have

disappeared from Texas, and the ocelot population is down to fewer than 100, although more survive in Mexico. The native vegetation is largely gone, but volunteers, private landowners, nonprofits and government agencies on both sides of the border are heroically trying to restore it and create more habitat for wildlife.

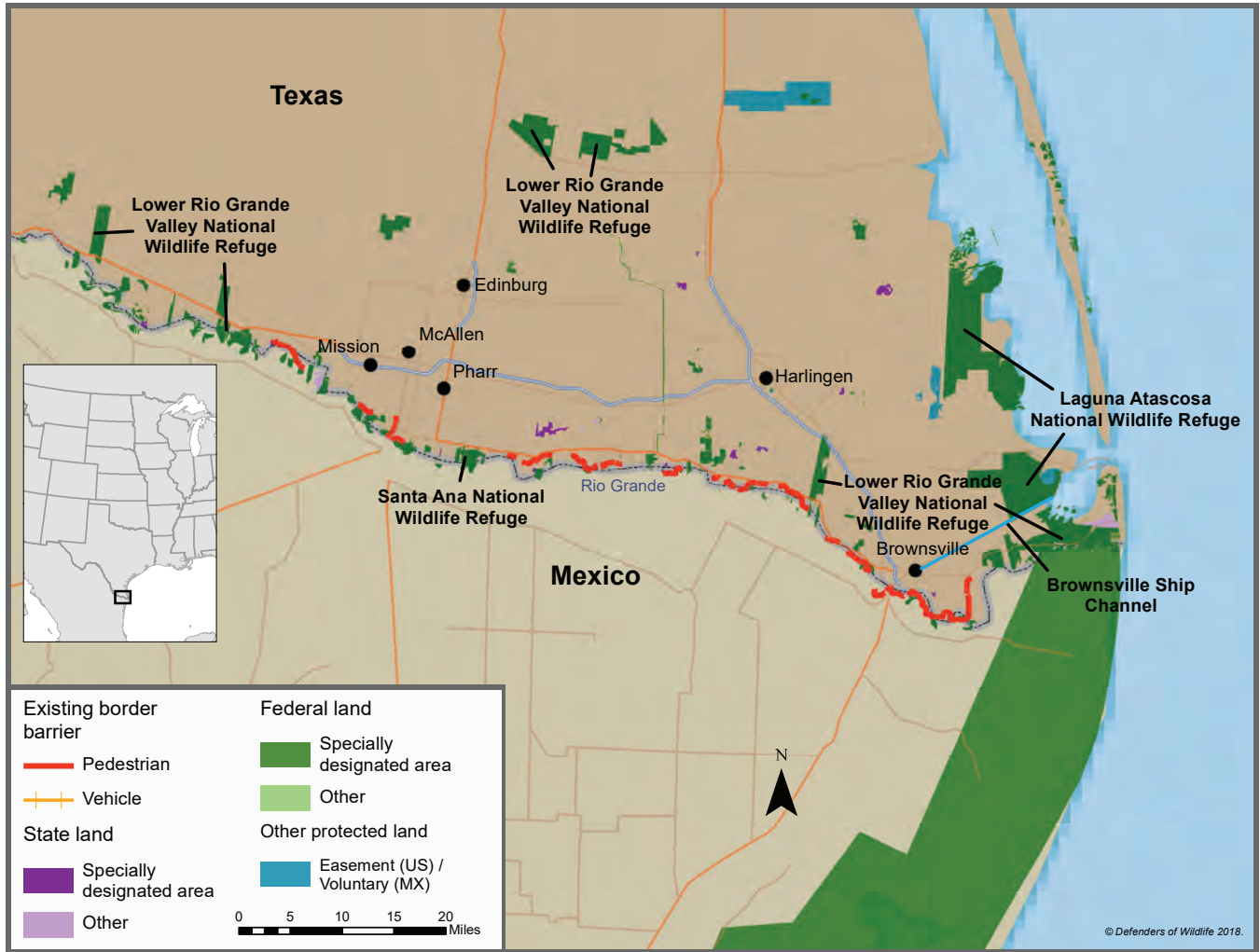


Figure 9b. Protected lands along the Lower Rio Grande—detail of national wildlife refuges

In winter, Laguna Madre hosts hundreds of thousands of shorebirds and waterfowl, including the largest concentration of redheaded ducks in the world (FWS 2013b). Bob Severson, vice-president of Friends of Laguna Atascosa National Wildlife Refuge, describes Laguna Madre as “a huge marine nursery that provides abundant food for birds and other marine life” (Severson 2017).

The third U.S. refuge, Lower Rio Grande National Wildlife Refuge, is a collection of more than 100 small tracts strung along a 275-mile stretch of river. FWS began acquiring these parcels in 1979 with the ambitious goal of protecting a wildlife corridor along the Rio Grande (FWS 2015) from the Laguna Atascosa refuge inland to the Santa Ana refuge and beyond.

Unfortunately, lack of money has kept FWS from completing the corridor, and the protected lands it manages along the river have no counterparts on the Mexican side.

Conservation collaborations

U.S. and Mexican agencies and organizations have a decades-long history of collaborating on conservation projects in the Lower Rio Grande area. From volunteers planting native vegetation to scientists developing the jaguar recovery plan, cross-border collaboration is key to conservation on this stretch of the border.

Tending to sea turtles

A binational team is working to recover the world’s most endangered sea turtle, Kemp’s Ridley, which nests on beaches in the western Mexico state of Tamaulipas and to a lesser extent at Laguna Atascosa National Wildlife Refuge (Sierra Club 2011).

Agency staff and volunteers in both countries work together to move eggs from vulnerable nest sites to protected hatching corrals. In 2017, training support from the U.S. nonprofit Sea Turtle, Inc. helped a Mexican biologist protect 40 nests at Playa Bagdad, a beach visible from the U.S. border.

DISAPPEARING SPOTS FOR OCELOTS

Ocelots need more room. The Lower Rio Grande national wildlife refuges have only 250 square miles fragmented in tiny tracts not large enough to sustain a healthy population of the endangered cats. The only refuge with a known ocelot population is Laguna Atascosa, with approximately 30 ocelots. A second, slightly larger population exists 20 miles away in Willacy and Kenedy counties, primarily on private ranches (FWS 2016c). With their remaining habitat largely surrounded by roads and developed land, the U.S. ocelots are often hit by vehicles—seven of them fatally from mid-2015 to 2016 (Friends of Laguna Atascosa National Wildlife Refuge 2016).

The best hope for long-term survival of Rio Grande ocelots is to enlarge and connect the two tiny, separated populations in United States with each other and with ocelots in Mexico (FWS 2016c). (See Figure 10.) Toward this goal, FWS is racing to acquire more refuge land before it is developed, but funds are lacking and development pressure is intense.

For example, windfarms are spreading through the

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valley (Kelley 2016a), and a private rocket-launching facility, SpaceX, is being built near refuge land. Liquid natural gas terminals proposed for both banks of the Brownsville Ship Channel (see Figure 9b) could prevent ocelots from swimming between refuge lands north and south of the channel (Nelson 2016).

Because FWS does not have the resources to acquire all the habitat ocelots need, The Nature Conservancy and other organizations are helping private landowners set up conservation easements, agreements to protect their land from development in perpetuity in exchange for federal tax benefits.

Recovering ocelots

Experts from the United States and Mexico jointly developed an ocelot recovery plan with a major goal of ensuring that ocelots can freely cross the border to interbreed (FWS 2016c). The Mexican nonprofit Pronatura Noreste is working with the Dallas Zoo, Environmental Defense and others in Tamaulipas state to survey ocelots and help landowners with projects like fencing sensitive areas of brush—ocelot habitat—from grazing (Cooperative Conservation 2017). On the U.S. side, FWS and The Nature Conservancy are acquiring private land to expand the refuges and working with landowners to protect habitat on private land. U.S. irrigation districts signed agreements to maintain ocelot habitat along canals (Winton 2017), and in 2016 the Texas Department of Transportation began constructing a dozen highway crossings for ocelots, spending \$8 million to decrease road mortality (Kelley 2016a).

Protecting waterbirds

The U.S.-based Coastal Bend, Bays and Estuaries Program collaborates with agencies and nonprofits to protect the

rookeries of egrets and other colonial waterbirds in the Laguna Madre of Texas and Mexico. The program worked with Mexican schools to educate communities and stop practices harmful to the birds like abandoning dogs on nesting islands, dragging fishing nets through nesting colonies, and using eggs and chicks as crab bait. The program also brought Mexican biologists to South Padre Island in Texas for training on identifying and banding shorebirds (Fitzsimmons 2017).

Reaching out to communities

In Tamaulipas state in Mexico, staff at the Laguna Madre biosphere reserve work with volunteers on what could be the world's largest beach-cleaning day—5,000 people turn out to remove trash during this annual event. As many as 100 trained volunteers from local fishing communities in the reserve also work each year with Pronatura and CONANP to count reddish egrets and piping plovers and to replant mangroves. U.S.-based organizations like the Rio Grande Joint Venture and Texas A&M provide financial and

technical support (Lerma 2018). Guadalupe Muñoz Pérez, member of a long-time fishing family, won Mexico’s Premio Nacional al Mérito Forestal in 2016 for her volunteer work protecting the bird colonies and mangroves. “Before, people burned the mangroves. Now we protect them because we know that if the mangroves are healthy, we’ll catch more fish,” she says (Muñoz Perez 2017).

In the United States, Gisela Chapa, community engagement liaison for the South Texas Refuge Complex, helps teachers use refuge lands as outdoor classrooms. “We’ve also got a partnership with the City of Alamo where we share the cost of a park ranger who develops youth programs,” says Chapa (Chapa 2017).

Volunteering at refuges

Retirees Kurt and Virginia Naville are among the thousands of people who volunteer at Lower Rio Grande Valley refuges. “We’ve been volunteering at the refuges for eight years, doing everything from documenting animals to cutting brush on overgrown two-track roads and replacing shot-up signs,” says Kurt (Naville 2017).

Bob Severson and his wife, Mary Ann, started volunteering in 2005 at the refuge and loved it so much that they moved nearby. “We’ve led bird tours, worked the visitor center, and we’re now helping with ocelot research,” says Bob (Severson 2017).

The Seversons and Navilles have also turned out for Rio Reforestation Day, an annual FWS habitat restoration event that attracts more than 1,000 helpers. Local farmers prepare areas for planting, and FWS supplies and sets out seedlings. The volunteers bring the shovels and do the planting—more

than 250,000 native tree and shrubs on over 700 acres since the event began 25 years ago (Friends of the Wild 2017).

“We’re helping in preserving this land for the future generations so everyone can grow up with the birds and animals I grew up with,” says Brownsville resident Julia Saenz, who shows up every year for Rio Reforestation to help transform former croplands into wildlife habitat (FWS 2013c).

Setting up conservation easements

For rancher Frank Yturria and his family, conservation begins at home. By setting up conservation easements—land-trust

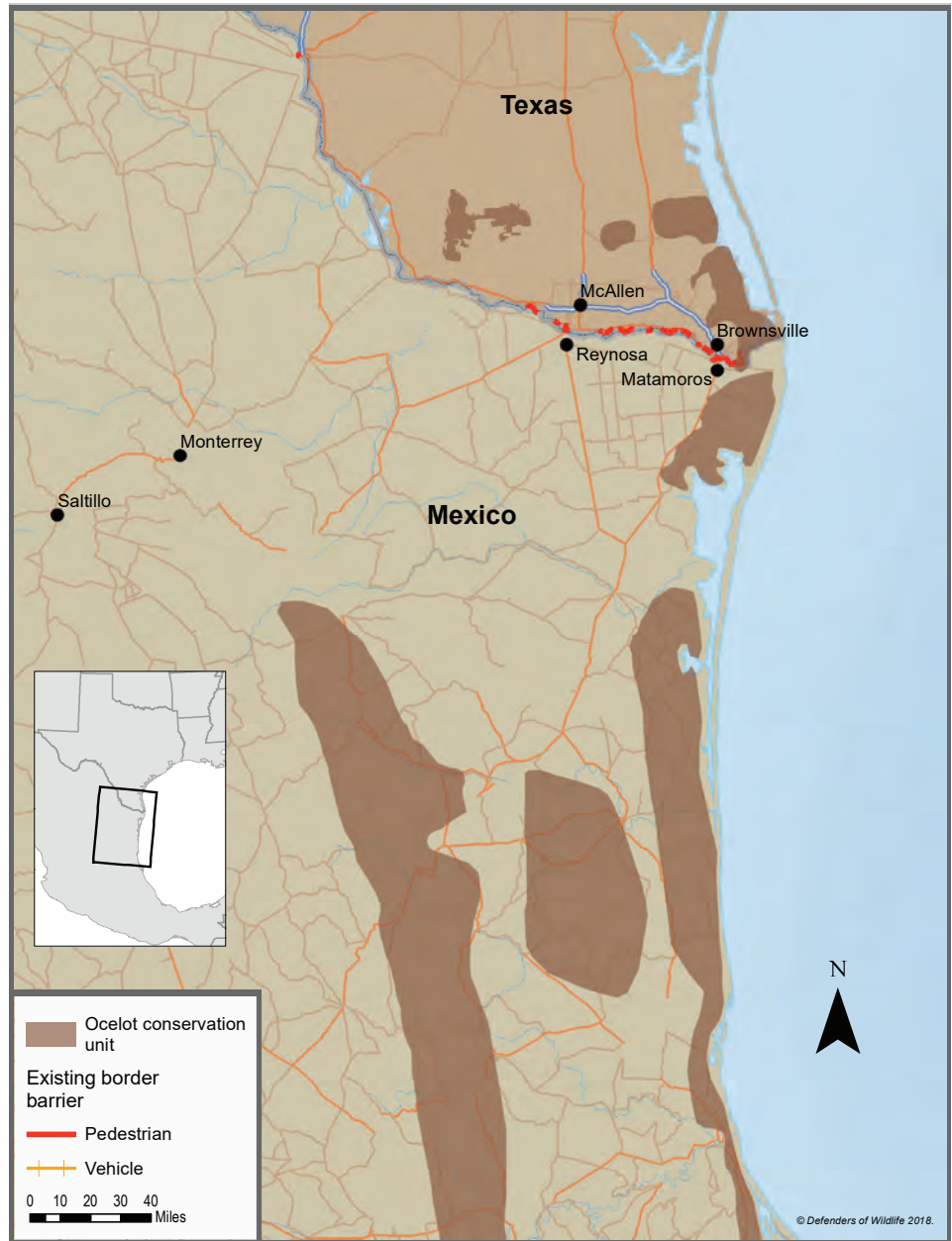


Figure 10. Ocelot conservation units



© ROBERT SEVERSON

Volunteer Bob Severson sets up a motion-triggered trail camera to document ocelot movement in Lower Rio Grande Valley National Wildlife Refuge.

agreements with tax benefits—they are protecting wildlife habitat on their ranch in Willacy County—and ensuring that it will never be developed. In 2016, two female ocelots birthed four kittens on this easement land (Petri 2016), which also harbors endangered Aplomado falcons. “If you can get the ocelot back, the falcon back, how’s it going to hurt us?” Yturria says (Brezosky 2011).

The looming threat of the wall

Texas has 115 miles of existing pedestrian wall (U.S. Customs and Border Protection 2017), primarily in a series of disconnected segments in the Lower Rio Grande Valley. In the race to recover ocelots and other rare species in the region, the border wall adds a new level of threat. If completed in additional sensitive places, the wall could undo the decades and millions of dollars spent on building a complex of refuges. The work of dedicated volunteers would be undone, the careful planning of wildlife professionals disregarded, and local economies devastated by the loss of the millions of ecotourism dollars brought in annually by the refuges.

The impacts of the wall on wildlife and habitat and conservation overall include:

Flooding. In 2010, Hurricane Alex flooded the Santa Ana refuge with water that killed trees, Texas tortoises and other animals—staff reported seeing rabbits stranded in trees (Findell 2011). The Department of Homeland Security plans to build a 30-foot high concrete and steel wall along the north side of the refuge where future flood waters could trap animals (Collier and Miller 2017). If the border wall is completed all along the river, many more of the Lower Rio Grande refuges could be in danger of flooding.

Blocked wildlife movement. The section of wall that bisects the 30-acre Lacoma tract in Lower Rio Grande National Wildlife Refuge near the town of Weslaco keeps wildlife north of the wall from reaching the most reliable water source in the area, the river. Linking the existing wall segments would complete the job of separating U.S. and Mexican animal populations.

According to FWS and its Mexican equivalent, Comisión Nacional de Áreas Naturales Protegidas (CONANP), connecting U.S. and Mexican ocelot populations is essential to ensuring the continued presence of ocelots in the United States (FWS 2016c). An impenetrable border wall would make



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The malachite butterfly is one of the nearly 300 species of butterflies found in Santa Ana National Wildlife Refuge.

that impossible, leaving the difficult and expensive option of translocation—moving ocelots from Mexico to the United States—the only alternative for ensuring the genetic health of the small U.S. population.

In addition to the physical barrier of the wall, associated infrastructure and human activity—road construction, observation towers, lights, noise and off-road patrols—would deter many animals from approaching and crossing roads (Trombulak and Frissell 2000). Plans for the Santa Ana refuge include a cleared zone 150 feet wide running along the wall within the refuge.

Reduced access for monitoring and management.

Managers need access to all parts of a refuge to monitor and manage species, control weeds, restore vegetation and maintain signs and fencing. A barrier erected in the last round of wall building hinders managers accessing trails at the Hidalgo Pumphouse tract of the Lower Rio Grande National

Wildlife Refuge (Schwartz 2017). The levee border wall planned for Santa Ana National Wildlife Refuge would also hamper staff access to refuge lands.

Loss of volunteer, recreation and education opportunities.

Refuges along the river attract bird watchers, involve volunteers and educate students, enriching lives and fostering love for nature. The same wall segment that hinders management at the Hidalgo Pumphouse tract, a World Birding Center site, prevents visitors from accessing the trails (Schwartz 2017). The border wall construction planned for Santa Ana would make the popular refuge and its trails inaccessible from the visitors’ center.

Hurdle to international cooperation.

According to one U.S. conservationist with a long history of cross-border work, “The wall would make cooperation with Mexican partners difficult and management would suffer. Wildlife knows no political



MIKE CARLO/FWS

A willet feeds along the beach on the Boca Chica tract of the Lower Rio Grande Valley National Wildlife Refuge, a haven for migratory shorebirds.

boundaries, so countries must work together, but the wall signals lack of trust and friendship.”

Diversion of resources. The race to protect and restore habitat in the United States before it is developed is already being lost because funds are lacking. Not only is the current administration squeezing budgets for land acquisition and management, by pushing the border wall it is threatening considerable investments in the area, including the \$8 million spent in 2017 to create road crossings for endangered ocelots (Kelley 2016b) and the \$90 plus million invested in refuge acquisition since the 1940s (FWS 2017b). The access limitations associated with the wall segment proposed for the Santa Ana refuge would affect education programs for schoolchildren and the enjoyment of the thousands who visit the refuge annually and contribute \$35 million to the local economy (Mathis and Matisoff 2004). The cumulative effects of the border wall throughout the Lower Rio Grande Valley could threaten the \$463 million contributed annually by eco-tourists (Woosnam et. al. 2012).

“The wall would make cooperation with Mexican partners difficult and management would suffer. Wildlife knows no political boundaries, so countries must work together, but the wall signals lack of trust and friendship.”

—A U.S. conservationist with a long history of cross-border work (name withheld by request)

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