Designing and Establishing Conservation Areas in the Baja California-Southern California Border Region

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ABSTRACT
The border region of Baja California in Mexico and California in the United States is a biologically diverse and unique landscape that forms a portion of one of the world's global biodiversity hotspots. While the natural resources of this border region are continuous and interconnected, land conservation practices on either side of the international boundary that bisects this area are quite different. These binational differences place certain natural resources, ecological processes, and wildlife movement patterns at risk of falling through the cracks of conservation efforts implemented in each country. Thus, effective conservation in this region requires binational cooperation with respect to conservation planning and implementation. This paper describes the differences in land conservation patterns and land conservation mechanisms between Baja California and Alta California (Southern California). The Las Californias Binational Conservation Initiative is discussed as a case study for binational cooperation in conservation planning.

Diseñando y Estableciendo Áreas de Conservación en la Región Fronteriza Baja California-Sur de California

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RESUMEN
La región fronteriza de Baja California en México y California en los Estados Unidos es un paisaje único y biológicamente diverso que forma una porción de una de las zonas clave (hotspots) de biodiversidad global en el mundo. Mientras que los recursos naturales de esta región fronteriza son continuos e interconectados, las prácticas de conservación del suelo en ambos lados de la frontera internacional que divide en dos esta área son realmente diferentes. Estas diferencias binacionales colocan a ciertos recursos naturales, procesos ecológicos, y patrones de movimiento de la fauna silvestre en peligro de caer a través de las grietas de los esfuerzos de conservación implementados en cada país. Así, la conservación efectiva en esta región requiere de la cooperación binacional con relación a los planes de conservación y su implantación. Este escrito describe las diferencias en los patrones de conservación del suelo y los mecanismos de conservación del suelo entre Baja California y Alta California (Sur de California). La Iniciativa de Conservación Binacional de Las Californias

es discutida como un estudio de caso para la cooperación binacional en la planeación de la conservación.

INTRODUCTION

The Southern California, United States-Northern Baja California, Mexico region (hereafter referred to as the border region) comprises a portion of one of the world's biodiversity hotspots (Dobson, et al. 1997, Mittermeier, et al. 1999, IUCN 2000). However, the biodiversity and environmental functions provided by the region's natural resources, such as water quality protection, water supply and flood control, and scenic and recreational resources, are increasingly threatened by expanding human land uses and modifications of the natural landscape (Ganster and Metzner 1993). Natural resources conservation efforts in San Diego County, California, and in Northern Baja California historically have treated the border region as two separate planning areas divided by the international border, leaving the natural resources of the region vulnerable to habitat fragmentation and loss of biodiversity. Such an approach in this historically interconnected landscape could result in two severed, dysfunctional landscapes. In addition, land ownership patterns and available mechanisms for implementing land protection differ between California and Baja California, complicating the establishment of a binational conservation reserve system. This paper summarizes the unique biological resources of the border region, describes land ownership patterns and conservation mechanisms on both sides of the border, and discusses a binational collaboration to identify a reserve network for the border region that would conserve a functional representation of the ecosystems in the face of rapid land use changes.

BIOGEOGRAPHY OF THE BORDER REGION

The border region lies at the center of the Peninsular or South Coast physiographic region or "ecoregion," which is part of the California Floristic Province—a recognized global biodiversity hotspot (Hickman 1996, Mittermeier, et al. 1999). The South Coast ecoregion is defined as the land area westward of the crest of the Peninsular Ranges, extending from approximately Santa Barbara, California, to El Rosario, Baja California (Figure 1). To focus attention on the status and conservation needs of the border region, this paper examines a subset of the South Coast Ecoregion, bounded generally by the Sweetwater River watershed to the north and the Río Guadalupe watershed to the south, and including a relatively small land area on the eastern side of the Peninsular Ranges (Figure 2).

The astounding biodiversity of the border region is largely a result of its high topographic, geologic, and climatic diversity, which forms a landscape of unique biogeographic subunits. The subunits are distributed throughout the region, along coastal to desert and elevational gradients, and underlie the tapestry of biodiversity that characterizes the border region. Effective conservation must account for the distribution of these biogeographic subunits, allow the movement

of species between them, and maintain processes underlying the ecosystems of the region.

Topography

The diverse topography of the border region ranges from flat coastal mesas and rolling foothills, to inland valleys and isolated mountain peaks, to the steep mountains of the peninsular ranges. Within the coastal plain, coastal mesas are fairly level, uplifted marine terraces that occur at elevations generally less than 400 meters (m). Eastward from the coast, coastal mesas transition into the foothills and ultimately to the peaks of the peninsular ranges, which reach more than 1,800 m in the Cuyamaca Mountains and Sierra Juárez. The Jacumba and In-Ko-Pah mountains (ca. 1,200 m) and Laguna Mountains (ca. 1,600 m) are other notable mountain ranges in the region. The peninsular ranges batholith is tilted to the west, which produces the rolling foothill topography on the western slope, but a very steep escarpment on the east. The border region also supports several significant valleys, including the Valle de Guadalupe, Valle de Ojos Negros, Campo Valley, and Jacumba/Jacumé Valley. Remnants of Mesozoic-era volcanoes (ca. 128 million to 117 million years ago [mya]) (Abbott 1999) form isolated peaks or cerros of gabbro and metavolcanic rock in a generally north-south swath throughout the western portion of the border region, including Otay Mountain, Tecate Peak/Cerro Cuchamá, Cerro San Isidro, Cerro Bola, Cerro Dieciseis, and Mother Miguel. In the eastern portion of the border region near Jacumba and Jacumé, more recent Miocene-age volcanics (18 mya to 19 mya) (Walawender 2000) formed andesite cinder cones and lava flows such as Table Mountain. The western flank of the peninsular ranges is dissected by the major drainage systems of the border region, including the Sweetwater River, Otay River, Tijuana River/Río Alamar, and Río Guadalupe, whereas the eastern flank is characterized by steeply incised canyons and *cañadas*.

Climate

The border region is characterized by a Mediterranean climate pattern, with mild, wet winters and hot, dry summers. However, temperature and precipitation patterns vary significantly throughout the region, influenced by elevation and the rain shadow of the Peninsular Ranges. Mean annual temperatures range from ca. 17ºC to 18ºC along the coast, 15ºC to 17ºC in inland valleys, to ca. 11ºC at the highest elevations in the Cuyamaca Mountains and Sierra Juárez. Freezing temperatures and frost are uncommon in coastal areas, but increase in regularity in inland areas and at higher elevations. Average annual rainfall is about 225 millimeters (mm) to 285 mm along the coast and varies widely in inland valleys (235 mm to more than 500 mm) and at higher elevations of the peninsular ranges (Delgadillo 1998; Western Regional Climate Center 2004). The Cuyamaca Mountains receive more than 850 mm of rainfall each year, whereas the Sierra Juárez range receives less than 400 mm. Higher elevations in the peninsular ranges also receive regular snowfall.

Biological Resources

The border region supports a high level of biodiversity of flora and fauna, including many endemic species, which have evolved within the diverse physical and climatic conditions of the region (Stebbins and Major 1965; Raven 1988; Mittermeier, et al. 1999). Biological resources can be organized into biological communities that are characteristic of specific biophysical and climatic conditions. For example, lower elevations within the border region support coastal scrub and chaparral communities, whereas higher elevation areas support conifer, oak, and cypress forests and woodlands. Coastal-draining stream systems are dominated by willows and cottonwoods, where water is abundant, and sycamore and oaks populate dryer areas. Eastern-draining streams and oases often support native palms. Community diversity in the border region is very high. For example, nearly a dozen different chaparral communities are distributed along elevation and climate gradients and among soil types. Many communities, such as vernal pools, are highly restricted in distribution and their compositions are unique to the border region.

The South Coast Ecoregion, including the border region, is one of the most species-rich regions of the California Floristic Province (Stebbins and Major 1965; Raven 1995). This is particularly notable, as the California Floristic Province is recognized as one of the world's richest floristic regions (Mittermeier, et al. 1999). Within the border region, endemic plant species are associated with isolated habitats such as vernal pools (e.g., Otay mesa mint), peaks of metavolcanic and gabbro rock (e.g., Tecate cypress), and high elevation "islands" (e.g., Cuyamaca cypress). Many plant species are listed as threatened or endangered or are otherwise considered sensitive, primarily due to habitat loss and fragmentation from development (Stephenson and Calcarone 1999; Flores Villela and Gerez 1994; Minnich and Franco Vizcaino 1998).

Although levels of animal endemism are not as high as that of plants, many resident and migratory wildlife species in the border region are listed as threatened or endangered or are otherwise considered sensitive. These species include invertebrates (e.g., Thorne's hairstreak, Quino checkerspot butterfly, and San Diego fairy shrimp), herpetofauna (e.g., arroyo southwestern toad, San Diego horned lizard, San Diego pond turtle), birds (e.g., California gnatcatcher, coastal cactus wren, least Bell's vireo), and mammals (e.g., Bighorn sheep, mountain lion, and American badger). The mammalian species, in particular, require large areas of unfragmented habitat to sustain viable populations.

LAND OWNERSHIP PATTERNS

Land Ownership in México vs. the United States

There is a tremendous difference in the ownership patterns of undeveloped, natural open space in the two countries. Approximately 61% of undeveloped land in the U.S. border region is federal, state, and locally-administered lands that are set aside as conserved open space or multi-use open space. Land use on privately owned lands is regulated by the local jurisdiction (city or county). Land

use on Indian reservations is outside of the county's land use authority, but must comply with federal regulations.

In contrast, <1% (ca. 5,000 hectares [ha]) of undeveloped land in the Baja California border region is in public ownership. Ownership of the remaining undeveloped lands includes *ejidos, comunidades, pequeña propiedades,* and *títulos colonias*. The *ejido* lands contain urban plots, individual parcels, and communally worked lands under a social structure. Lands that are part of a *comunidad* are collectively worked, usually by indigenous people. Communities may privatize and become *ejidos*. *Ejidos* and *comunidades* can make decisions on appropriate land uses within their boundaries. A 1992 constitutional change allows ejidos to sell individual parcels under the Programa de Certificación de Derechos Ejidales y Titulación de Solares Urbanos (PROCEDE) process.

Protected Areas in Baja California

Historically, protection of natural resources in Mexico has been the responsibility of the federal government, which established the Sistema Nacionál de Áreas Naturales Protegidas to achieve this conservation objective. However, in contrast to practices in the United States, the Mexican government establishes natural protected areas with land use restrictions over private lands, without any compensation for the landowners. This system, and the lack of active management due to the scarce economic resources available for conservation, has resulted in inadequate administration and management of natural protected areas.

Parques Nacionales and Areas Naturales Protegidas

In Mexico, protected areas are classified by a management category that infers the ecological function(s) contributed by each area. Of all the Mexican states, Baja California supports the largest area (as opposed to the largest number) of government-decreed protected areas (Flores Villela and Gerez 1994), including:

- National Parks (e.g., Parque Nacionál Constitución 1857, Parque Nacionál San Pedro Martir)—The objective of these protected areas is to conserve a biogeographic representation of one or more ecosystems that have aesthetic, scientific, educational, recreational, and/or historical value and can be used for tourism.
- Biosphere Reserves (e.g., Alto Golfo de California y Delta del Río Colorado)—These are areas representative of one or more ecosystems, not significantly altered by humans, that support endemic, threatened, or endangered species.
- Areas of Protection of Natural Resources (e.g., Valle de Los Círios)—These areas are conserved for the preservation and restoration of forested areas and conservation of land and water.

Within the border region, Parque Nacionál Constitución de 1857, encompassing approximately 5,000 ha, is the only government-decreed protected area.

Private Conservation Areas

Mexico's total surface is 197.7 million ha, of which 89.6% is rural lands (nearly 175 million ha). Of this, 41% is private property owned by 1.4 million pequeños *propietarios* and 58.6% is social property owned by 3.5 million ejidatarios and *comunero*s (CESPEDES and Pronatura 2002). However, due to the lack of education and incentives, most of the private and social landowners have not assumed the responsibility to conserve biological resources on their lands.

Recent efforts by conservation organizations in Baja California promote the constitution of private conservation reserves together with the use of incentives or compensations for landowners. The *servidumbres ecológicas* (conservation easements) established in Tecate, Baja California and Bahía de Los Angeles through an agreement between landowners and Pronatura are examples of these efforts.

Protected Areas in Southern California

Areas of natural open space in the United States are owned by federal, state, and local government agencies, private nongovernmental organizations, and private land owners. Many of these lands have management mandates for multiple uses, such as recreation, timber harvest, grazing, and resource extraction, which can conflict with the protection of particular natural resources. The land management status of natural open space in the United States, and thus its protection status, is described and cataloged by the GAP program (Scott, et al. 1993). GAP category 1 lands are those with the strictest, natural resources-driven management programs. In the border region, designated wilderness areas are considered GAP category 1 lands (Figure 2).

Federal Land

The largest area of protected land in the U.S. portion of the border region is under federal ownership. There are approximately 129,715 ha of federal land, in the border region. These include the Cleveland National Forest (including the Pine Creek Wilderness), San Diego National Wildlife Refuge (Otay-Sweetwater Unit, South San Diego Bay Unit, Vernal Pool Unit), Tijuana Slough National Wildlife Refuge, Sweetwater Marsh National Wildlife Refuge, Otay Mountain Wilderness Area, Hauser Wilderness, Sawtooth Mountains Wilderness, Carrizo Gorge Wilderness, Jacumba Wilderness, and other properties administered by the Bureau of Land Management (BLM).

State Land

The State of California administers 41,542 ha in the border region. The Department of Fish and Game manages the Rancho Jamul Ecological Reserve (including Honey Springs Ranch), Crestridge Ecological Reserve, Hollenbeck Canyon Wildlife Management Area, and McCain Valley Wildlife Management Area. The Department of Parks and Recreation manages Anza-Borrego Desert State Park, the largest state park in California (including the Whale Peak Wilderness, Sombrero Peak Wilderness, and Carrizo Canyon Wilderness), Cuyamaca Rancho State Park in the Cuyamaca Mountains, and Border Field

State Park on the coast. The Department of Forestry and Fire Protection administers a single property on the border, Tecate Peak.

Local Government Land

The City of San Diego, City of Chula Vista, and County of San Diego own preserve lands within the Multiple Species Conservation Program (MSCP) area, which are conserved as mitigation for development impacts in the region. These include Marron Valley on the border, Otay River Valley Park, and Tijuana River Valley Park. The City of San Diego Water Department also owns watershed lands around the Otay Lakes, Barrett, and Morena reservoirs, which are protected to prevent degradation of the municipal water supply.

Private Conservancies

Private conservancies, such as The Nature Conservancy and Trust for Public Land, purchase properties for conservation and turn over ownership and management to a government agency or community-based land trust. Many of the lands within the San Diego National Wildlife Refuge were acquired under this scenario. For example, McGinty Mountain, owned by The Nature Conservancy, will be deeded to the U.S. Fish and Wildlife Service as part of the refuge. There are few community-based land trusts in the border region that own and manage protected land.

Examples of Binational Conservation Projects (Baja California-California)

The first binational easement (*servidumbre*) between Mexico and the United States was signed in March 2003. The easement protects the highest peak in Tecate, Baja California, known as Cerro Cuchumá to the native Kumeyaay Indians, who consider the mountain sacred. This chaparral-covered mountain supports endemic plants and other species protected by the Mexican Official Rule 059-ECOL-1994. The approximately 819 ha easement restricts land uses to those consistent with the conservation of its biodiversity, such as research.

Two binational conservation and restoration projects have been initiated under the Coastal Training Program of the Tijuana River National Estuarine Research Reserve in San Diego County. Both projects would result in an extension of the reserve into Mexico. Los Laureles Canyon in urban Tijuana is a significant source of sediment released into the Tijuana River Estuarine Reserve. A binational effort is underway to revegetate the upper watershed, remove invasive species, stabilize the least-degraded part of the canyon, construct an artificial wetland, and establish a recycling center administered by community groups. The Matadero Canyon Conservation Park within the city of Tijuana will provide crossborder educational opportunities, environmental interpretation, and low-impact recreational use. The park will be administered by a new non-governmental organization (NGO), created with the assistance of Pronatura and Mexican government officials.

Implementing Mechanisms

There are many cultural, socioeconomic, and lingual barriers to transborder conservation efforts, and there is inadequate public education on the benefits of habitat conservation to the economy and standards of living. Moreover, legal mechanisms for land conservation differ widely in Mexico and the United States, further complicating binational conservation implementation. The following section discusses some of the legal mechanisms that are available to implement a conservation strategy. Different mechanisms may be appropriate for different parts of the border region, depending on ownership, land use, socioeconomic factors, and level of participation by government and non-governmental organizations and community groups.

Baja California

Decreto Federal o Estatal (Federal or State Decree)

Federal, state, or municipal government agencies can define parks or natural protected areas (*areas naturales protegidas*) by decree. However, land within these areas may be privately owned, and land owners within natural protected areas often are not compensated for economic losses associated with the decreed land use limitations. Consequently, these private lands may not be managed in a manner consistent with the protection of natural resource values. Incentives and land management guidelines are needed to supplement this designation.

Plan de Desarrollo Urbano del Municipio (City's Master Plan)

This municipal plan for urban development, which is updated every two years, establishes strategies, policies, and actions that will support sustainable growth. See, for example, *El Plan de Desarrollo Urbano del Centro de Población de Tijuana 2025* (IMPlan 2002). One drawback is that the plan can change when government changes.

Plan de Ordenamiento Ecológico Territorial (State's Master Plan)

This is a governmental policy tool whose purpose is to regulate and control land use and production activities, provide for environmental protection, and allow for preservation and sustainable use of natural resources. For example, scientists from the Universidad Autónoma de Baja California are assisting the City of Tijuana with the identification of important natural resource areas (*areas verdes*) as part of the *ordenamiento ecológico* for the município. The *ordenamiento* will be used to guide land development within Tijuana. This tool lacks legal enforcement capability when land uses are changed from conservation to development (Gobierno de Baja California 1995).

Other Land Use Policies or Zoning

A *declaratoria* is a special zoning tool that could be used by the state or municipality to conserve woodlands. *Declaratorias* have proven to be ineffective in Baja California because of the poor enforcement capability of the public sector (Graizbord and de la Fuente in prep.).

A municipal land bank allows municipalities to designate lands they own for special uses, such as low-income housing or conservation. They can also sell land cheaply. *Permutas* allow cities to exchange land in ecologically sensitive areas for areas of equal monetary value though less sensitive.

The policy of *Manejo Sostenible del Uso de Vida Silvestre* (UMA) under the Ley de Vida Silvestre, or Management and Sustainable Use of Wildlife under the General Law of Wildlife, is an incentive that allows for the development of productive alternatives compatible with protection of natural resources and biodiversity. The objective is to provide for conservation of managed species while improving quality of life for the community (Cariño 2004). This tool has been successfully used for gray whale protection in Laguna San Ignacio, B.C., and could be used for the conservation, reproduction, and commercialization of Bighorn sheep

Legal Conservation Tools for Changes in Land Use Rights

Mexico's conservation policies and the mosaic of land ownerships in Baja California have been primary obstacles to establishing mechanisms for the protection of natural resources. For this reason, changes in land use rights have been explored as a mechanism for conservation. Individuals, indigenous groups, and NGOs such as Pronatura have been working to develop mechanisms for the protection of natural resources on private lands (Gutiérrez Lacayo, et al. 2002). Legal conservation tools that allow landowners to voluntarily restrict the type and amount of development to protect natural resources are relatively new in Mexico (Gutiérrez Lacayo, et al. 2002). Some examples are described below.

Donation or purchase—This is the most complete and secure way of protecting land, but it is rare in Mexico. There are legal restrictions on the amount of land a person can buy or own. Tax-exempt NGOs are restricted from owning more land than "their immediate goals require" (Corcuera, et al. 2000), and administering the land requires resources beyond the capabilities of most NGOs. Foreigners are not allowed to own land in the 100 kilometer (km) strip along the border and 50 km strip along the coast, unless through a bank trust (*fideicomiso*). Income tax deductions are allowed for donations, although one must petition the Secretaría de Hacienda y Crédito Público. Many reassess land to decrease its value to development, and thus protect it. However, current low land values in Mexico negate this as an incentive. This practice works best on large, poor *ejidos*.

Bequest—This is the same as a land transfer or donation, but stipulated in a will and transferable after death (Corcuera, et al. 2001).

Parques privados—The establishment of private parks in Mexico occurs mostly without legal guarantees (Corcuera, et al. 2000). The first private conservation donation was El Eden research station in Quintana Roo in 1990.

Usufructo (right of use)—An *usufructo* is a written agreement for a stipulated time that gives a third party the right to use the resources on a property for certain purposes (in this case, conservation). The contract is not tied to the land and expires with death of the landowner. The owner also retains the right to use, sell, donate, or pass on the land to heirs (Gutiérrez Lacayo, et al. 2002). In this situation, an NGO could acquire lands from the owner and grant a restricted *usufructo* back to the landowner, or landowners could rent the *usufructo* land to private companies for specified purposes, such as camping or ecotourism.

Fideicomiso (property trust)—A person can grant property through a financial institution (usually a bank) for conservation purposes, documented by a contract on rights of use. *Fideicomisos* even allow foreigners to own property within the restricted areas, although the title is held by the financial institution. *Fideicomisos* are easy to create under the *ley de operaciones de credito* and allow many people to invest land, money, and services. There is a limit to the contract period, depending on the kind of *fideicomiso*. Nationally, the tourism department of Mexico, FONATUR, uses this system to develop land (Gutiérrez Lacayo, et al. 2002). This tool was used locally by PRODUTSA in Tijuana to develop the Río Tijuana 3a. Etapa, Corredor Tijuana-Rosarito 2000, and San Antonio del Mar development (Lemus 2004), but can be used for conservation as well.

Servidumbre (easement)—There are many types of *servidumbres*. The *servidumbre ecológica* (conservation easement) is a voluntary legal agreement between two or more property owners in which the rights of one are restricted in the type or intensity of land use allowed on the property, with the objective of preserving natural resources, scenic beauty, or historical and cultural values of the land for a designated period of time or in perpetuity. The *servidumbre* stays with the land and not with the property owner. The property that receives the benefit is designated the *predio dominante,* and the property that confers the benefit is the *predio sirviente*. There are also *servidumbres ecologicas reciprocas* in which there are reciprocal restrictions on each property. The properties can be contiguous or non-contiguous. *Servidumbres ecologicas* can be used to conserve areas of biological richness, protect endangered species, allow use as wildlife movement corridors, or maintain sustainable land use practices. Restrictions that may be placed on properties can vary by property and include hunting, cutting, or clearing trees and other vegetation, impeding wildlife movement, burning, construction, subdividing the property, or housing density. Many of these restrictions on public recreation can benefit ecotourism in Mexico, which depends on the conservation of threatened or unique ecosystems. Rancho Cuchumá is the only example of a *servidumbre ecologica* in the border region.

Southern California

There are a multitude of federal, state, and local regulations that restrict adverse impacts to the environment, including air, water, land, cultural resources, and socioeconomic impacts. Some of these regulations provide mechanisms by which natural resources and open space are protected. The following discussion

summarizes a few of the laws that affect conservation of natural resources in California.

Federal Regulations

National Environmental Policy Act and Endangered Species Act—Federal projects, projects on federal lands, and projects receiving federal funding are subject to environmental review under these two acts. In addition, non-federal projects that may affect federally listed threatened or endangered species are subject to federal Endangered Species Act regulations. Projects that may cause significant adverse impacts to natural resources or jeopardize the continued existence of federally listed species must mitigate these impacts, often by establishing conservation areas as mitigation. Where there are incidental, adverse impacts to listed species by nonfederal projects, a Habitat Conservation Plan (HCP) must be prepared to demonstrate that habitat and species conservation actions, including long-term biological management and monitoring, will mitigate impacts and contribute to the recovery of those species.

Clean Water Act—The U.S. Army Corps of Engineers administers this act, with oversight from the U.S. Environmental Protection Agency and (EPA) U.S. Fish and Wildlife Service. The Clean Water Act regulates adverse impacts to "waters of the U.S." and wetlands and can require mitigation for permitted impacts in the form of wetland and aquatic habitat conservation and restoration.

Federal Conservation Programs

National Fish and Wildlife Refuge—Within the border region, federal funding is being used to purchase private lands within the Otay-Sweetwater Unit of the San Diego National Wildlife Refuge and to develop a management and land use plan for the South Bay Unit of the San Diego National Wildlife Refuge. These lands are considered federal contributions to the Multiple Species Conservation Program (MSCP) preserve system in southwestern San Diego County.

Recovery Land Acquisition Grants Program (subsidized through Section 6 of the Endangered Species Act)—Funding from this program is available to purchase land benefiting federally listed threatened and endangered species.

Forest Legacy Program—The U.S. Forest Service administers this voluntary program in cooperation with the California Department of Forestry by purchasing qualified private properties and conservation easements to maintain forest integrity. The Descanso Legacy Area is within the border region.

Natural Resources Conservation Service—This branch of the U.S. Department of Agriculture works with private landowners to manage land for natural resource values, under provisions of the Farm Bill 2002.

State Regulations

California Environmental Quality Act (CEQA), California Endangered Species Act, and Natural Community Conservation Planning (NCCP) Act—Development

projects are subject to environmental review under CEQA and must comply with a host of other environmental regulations and permitting requirements. Projects that may cause significant adverse impacts to natural resources or jeopardize the continued existence of state-listed endangered or threatened species must mitigate these impacts to a level that is less than significant by modifying the project or by providing long-term conservation and management of natural resources that would be affected by the project. For example, land developers and other project proponents often purchase or establish conservation easements on land as “mitigation” for project-related biological impacts.

Historically, open space mitigation was accomplished on a project-by-project basis; the result was a fragmented patchwork of conserved land that cannot sustain biological resources over the long term. In 1991, California adopted the NCCP Act, which provides for comprehensive land use planning to comply with California Endangered Species Act regulations. The NCCP Act allows local jurisdictions to plan for conservation of ecosystems and ecosystem processes while allowing for reasonable economic growth. Compliance with the NCCP Act and California Endangered Species Act is often coordinated with federal Endangered Species Act compliance, resulting in the preparation of joint NCCP/HCP plans that specify reserve systems of natural open space to protected currently listed species and preclude the need for the listing currently unlisted species in the future.

Local jurisdictions in Southern California, including the City and County of San Diego, were among the first to undertake joint NCCP/HCP planning. NCCP/HCP planning is conducted on a subregional basis, where a subregion consists of a group of local jurisdictions within an ecoregion (e.g., South Coast ecoregion). In southern San Diego County, conservation planning in the coastal jurisdictions has been completed, and inland portions of the county will have planning initiated in the near future. Both the City and the County of San Diego must annually appropriate funds for acquisition, management, and monitoring of this open space. The Sweetwater Authority and Otay Water District are in the process of completing NCCP/HCP plans that will formally designate watershed lands they own as conserved open space. NCCP/HCP plans have resulted in a significant amount of open space conservation in San Diego County and are an important conservation tool for local governments.

State Conservation Programs

Multiple State of California departments and agencies have programs for habitat conservation, including the Department of Parks and Recreation, Department of Fish and Game, State Lands Commission, California Coastal Commission, and Wildlife Conservation Board, which is a source of funding for acquisition of important natural resource areas. In addition, several state propositions have been enacted by California voters in recent years that authorize bonds for conservation of natural open space, water resources, and park lands. These bond measures have provided substantial funding for natural resources

conservation that are often used to leverage additional funding from private foundations and non-governmental conservation organizations.

Local Regulations

The border region encompasses portions of the cities of Chula Vista, Imperial Beach, National City, and San Diego in the west and the County of San Diego in the eastern, unincorporated portion of the border region. Each municipality regulates land use and development within its jurisdiction. Many of these land use regulations either directly provide for protection of natural resources or require that development projects mitigate impacts to species and habitats by protecting lands outside of the development project.

General Plans/Zoning—In California, general plans describe policies that guide land uses within a city or county jurisdiction, generally over a 20-year planning horizon. A conservation element is a mandatory element of a general plan that provides guidance regarding the conservation, development, and use of natural resources. Once a general plan is approved, the local jurisdiction then "zones" the type and intensity (density) of land uses that are allowed. Certain land uses are compatible with natural resources protection, while many are not. Thus, while general plans can provide important conservation implementation mechanisms, they often reflect the political sentiments of individual Boards of Supervisors or City Councils and, in many instances, facilitate urban sprawl rather than effective conservation. The County of San Diego is currently revising the General Plan for the unincorporated part of San Diego County. If adopted, the County of San Diego General Plan Update 2020 would encourage lower density development in the border region than the current general plan.

Transfer or Purchase of Development Rights—With the transfer or purchase of development rights, a landowner has the right to sell the development rights to his land. The seller gives up the development rights (emitting zone), and the buyer uses them to build on a more appropriate piece of land (receiving zone). This tool is proposed for use as part of the County of San Diego General Plan Update 2020.

County of San Diego Biological Mitigation Ordinance and Resource Protection Ordinance—The County of San Diego enacted the Biological Mitigation Ordinance to legally implement the MSCP. The ordinance establishes criteria for avoiding impacts to important resource areas and outlines mitigation requirements for all discretionary permit projects. The county's Resource Protection Ordinance applies in unincorporated areas where the MSCP has not yet been adopted. It establishes development controls on environmentally sensitive lands, including wetlands, floodplains, steep slopes, and sensitive biological habitats (e.g., habitats that support rare or endangered species or function as a wildlife corridor).

City of San Diego Environmentally Sensitive Lands Regulations, Resource Protection Ordinance, and associated guidelines—As part of adopting the MSCP, the City of San Diego enacted these regulations to legally implement the MSCP. The guidelines stipulate the biological standards that must be followed to receive a development permit from the city and the amount and location of lands to be conserved as mitigation.

Local Conservation Programs

Local municipalities have a variety of ways to raise money for conservation purposes. These can include property taxes, sales and use taxes, transportation taxes, special assessment districts, impact fees (one-time cost to developer), general obligation bonds, revenue bonds, etc. Currently, the San Diego Association of Governments (SANDAG) is discussing the parameters for a transportation tax that would not only pay for transportation improvements, but would also support acquisition, management, and monitoring of lands for open space as mitigation for transportation projects.

Mitigation banks—If approved by federal and state wildlife agencies, a property owner can sell "mitigation credits" on his land to other property owners or developers requiring mitigation land for development impacts. The number and value of credits depend on the level and location of impact and the type of resources affected.

Private land conservancies—In Southern California, many private nonprofit organizations conserve land for natural and cultural resources protection, scenic beauty, recreation, community open space, and agricultural resources. These organizations vary in size and scope, from very large organizations with a global influence (e.g., The Nature Conservancy), to small, community-based land conservancies focused on a particular area or watershed. In the border region, a few small land trusts are conserving and/or managing natural open space areas.

Land transfers—The main use of this mechanism is to avoid the bureaucratic delays that governments experience when buying land. A land trust typically holds the land until the government is ready to pay for the land.

Land exchanges—Landowners can exchange property for other property without having to incur a capital gain on the transaction. This allows a landowner to continue to own valuable real estate, but transfer ecologically significant property to a land trust.

Land donations—There are federal income tax deductions as incentives for land donations for conservation.

Bargain sale—A landowner can sell his property for less than fair market value and claim a charitable deduction for income tax purposes for the difference between the bargain sale price and fair market value.

Conservation easements—A landowner can voluntarily place a conservation easement on his property that legally restricts the uses within the easement to protect the natural resources. The easement is typically transferred to a conservation organization or government agency. The easement is specific to each property and stays with the land in perpetuity, regardless of ownership. There are federal income tax benefits of donating a conservation easement. The value of an easement is generally the difference between the value of the land with the easement (i.e., with land use restrictions specified by the easement) and the value of the land without the easement (i.e., without the easement restrictions).

LAS CALIFORNIAS BINATIONAL CONSERVATION INITIATIVE

Need for the Project

The border region is a biologically diverse and unique landscape, at the center of one of the world's global biodiversity hotspots. More than 400 species in this region have been identified as endangered, threatened, or otherwise sensitive to human impacts. Historically, planning processes on both sides of the border have not recognized the shared resources and complementary conservation opportunities of the border region itself. The region's biodiversity and environmental services, such as water quality protection, water supply and flood control, and scenic and recreational resources, which function across large binational landscapes and watersheds, are increasingly threatened by expanding human land uses and modifications of the natural landscape. Thus, effective conservation in this region of more than 5 million people requires binational cooperation with respect to conservation planning and implementation.

The U.S. government and State of California have already designated more than 150,000 ha as protected public open space in the border region of San Diego and Imperial counties, which is complemented by more than 5,400 ha of county and city lands. In contrast, only 5,828 ha in Mexico (5,009 ha at Parque Constitución de 1857 and 819 ha at Rancho Cuchumá) are currently protected within the border region. The biological integrity of this enormous public conservation investment will be jeopardized if additional conservation efforts are not implemented in a cooperative, binational manner.

Threats

The urgency of this program is marked by a rapidly urbanizing triangle of land between San Diego, Tijuana, and Tecate, and their adjacent suburbs. In addition, the currently affordable land values in the eastern portion of the border region present a short-term opportunity to shape binational land protection patterns. Population growth and development patterns on both sides of the international border are quickly compromising our ability to conserve a representative portion of the South Coast Ecoregion in Southern California and northern Baja California.

Connectivity between high value wildland areas is critical to maintaining the values of the existing conservation investments described above. Historically, species dispersed freely across the international border. Road and highway corridors and associated developments are now major impediments to wildlife movement. Interstate 8 and State Road 94 in the United States and Mexico Highway 2 largely sever connectivity between habitats north and south of these roads, and increasing development along these transportation corridors is closing off opportunities for designating a transborder habitat linkage. Sand mining in stream channels and riparian habitats, low density rural development of the backcountry, and agricultural activities on both sides of the border are affecting habitats and water supplies, which could severely impact plant and animal habitats. In addition, new casinos and related projects have been proposed by Native American reservations in southern and eastern San Diego County and are not currently governed by county or state policies and regulations.

Increased development brings with it a human need for increased open space, particularly in Mexico where there is very little public land or designated open space. The patterns of ownership, land uses, topography, and biological resources suggest the need for binational conservation areas that represent these patterns. Conservation of habitats along the border, as opposed to development, would not only protect ecological integrity but would also symbolize a unified conservation ethic for the two countries and lay the framework for renewed cooperation.

Objectives

Conservation planning may focus on a variety of factors, such as protecting rare or at-risk species or habitat types, ensuring adequate representation of vegetation communities, conserving intact habitats or watersheds, maintaining important landscape connections or wildlife movement corridors, among others. Habitat conservation efforts are most effective when planned using a science-based approach that seeks protection for suites of conservation attributes (Kirkpatrick and Brown 1994; Noss, et al. 1999). The suites of conservation attributes considered in reserve planning must be tailored to the ecosystems of the focal area and shared public values, which are often embodied in environmental regulations and land use policies. Identifying and prioritizing land areas that form a functional reserve system in a collaborative, binational fashion has the potential to produce an outcome that can be shared by all levels of governmental and non-governmental agencies on both sides of the border.

To facilitate effective, binational natural resources conservation in the border region, the Las Californias Binational Conservation Initiative is being conducted by a partnership of Mexican and U.S. NGOs, including Pronatura, Conservation Biology Institute, and The Nature Conservancy. The Las Californias Initiative will propose a binational conservation strategy for the border region that will:

- Lay the foundation for a binational park system that connects the Parque Constitución de 1857 in Mexico to wilderness areas, forests, and park land

in the United States
- Protect unique natural resources shared by the two countries, in an area of rich biological and cultural heritage, that stretches from the coast to the mountains to the desert
- Link protected areas to support cross-border wildlife movement, such as that required for the federally (U.S.) endangered desert Bighorn sheep
- Promote land protection strategies that involve local communities and result in secure and sustainable conservation

There are many examples of binational or transboundary conservation areas and initiatives throughout the world. They include:
- "Peace Parks" such as Kruger in South Africa/ Zimbabwe/Mozambique and Waterton-Glacier Park in the United States and Canada
- Large-scale wildlife corridor projects that focus on a specific species to generate support, such as the *Cordillero del Condor* between Ecuador and Peru and the *Paseo del Pantera* across Mesoamerica
- Ecoregional planning approaches that focus on biodiversity conservation (e.g., The Nature Conservancy's Sonoran Desert Ecoregion plan in Arizona/Mexico) or use watersheds and water issues as a unifying theme (Dommel River watershed in Poland and the Mimbres sub-basin in New Mexico/Mexico)

The Las Californias Binational Conservation Initiative hopes to elevate the visibility of the border region's conservation values on an international scale.

Approach
The Las Californias Initiative employs the SPOT (Spatial Portfolio Optimization Tool) reserve design algorithm. SPOT uses a simulated annealing technique, originally developed for the SITES reserve selection algorithm (Andelman, et al. 1999) to find the minimum area that meets established conservation goals, in the least fragmented configuration, within a landscape of "costs" (TNC 2003). For the Las Californias Initiative, the cost landscape is derived from the spatial distribution of roads and land cover, such as development and agriculture, which reflects the integrity of habitats. Thus, SPOT efficiently identifies a reserve system that maximizes achievement of conservation goals within the most intact habitats.

SPOT is run within a Geographic Information System (GIS) platform, using existing digital data sets. Inputs to the model include the distribution and magnitude of costs, conservation targets and quantitative goals for these targets, parameters that guide the algorithm with respect to allowable fragmentation, and penalties for missing conservation goals.

Producing seamless, standardized data layers for the border region has been a great challenge. Maps of vegetation communities, land use, and roads for the border region were assembled from numerous U.S. and Mexican sources. The

constituent data layers differ with respect to scale, detail, and mapping convention. This often requires that more detailed data sets be generalized to allow integration with less detailed data sets. In addition, many data layers (e.g., vegetation communities) are mapped with different classification systems in Southern California and Baja California (Holland 1986; INEGI 1997), which complicates the establishment of regionally consistent conservation targets and goals.

CONCLUSIONS

The border region of Alta and Baja California—Las Californias—lies at the center of one of the world's biodiversity hotspots, harboring ecosystems and species that occur nowhere else on earth. It is also a growing, multi-national metropolitan area of more than 5 million people. The integrity and functionality of ecosystems in the border region, as well as the health, economy, and standards of living of its human population, depend on a system of open space reserves that are interconnected across the international border. The urgency of this need cannot be overstated, as the ever-growing human footprint of development is beginning to preclude opportunities for protecting a functional open space reserve system.

However, there are institutional and political constraints to a binational conservation effort in this region. There is a tremendous difference in the ownership and conservation patterns of undeveloped, natural open space in the two countries, with a far greater percentage of both public ownership and conserved land in California than in Baja California. Moreover, differences in legal mechanisms and available financial resources for achieving land conservation in the two countries complicate coordination.

The Las Californias Binational Conservation Initiative takes a phased approach to conservation in the border region. The planning phase uses a science-based approach, with uniform conservation targets and goals across the binational region, to identify significant natural resource areas. The objective of the planning phase is to identify areas that must be linked to conserve representative biodiversity, functional ecological processes, and wildlife movement across the region. The ultimate goal for the initiative is for U.S. and Mexican governments, academic and research institutions, and non-governmental conservation organizations to embrace and adopt a shared conservation vision for the region.

Implementation actions must include a heightened visibility of conservation objectives and an understanding of the inherent barriers, such as that posed by U.S. Homeland Security programs. The triple fencing project in the western portion of the border region will significantly compromise landscape connectivity if continued eastward. On the other hand, increased conservation of open space in the border region could facilitate border enforcement, without the need for extensive physical barriers, by allowing the use of sensor and remote-sensing technologies.

Using a single, shared conservation blueprint for the border region allows coordinated implementation by different groups on both sides of the border. Coordinated, but separate, implementation actions are currently necessary because of the differences in land protection status and legal mechanisms available for conserving land in the two countries. Therefore, the implementation strategy developed in subsequent phases of the Las Californias Initiative must identify specific conservation mechanisms for individual portions of the blueprint, based on ownership, surrounding land uses, and available legal tools and funding.

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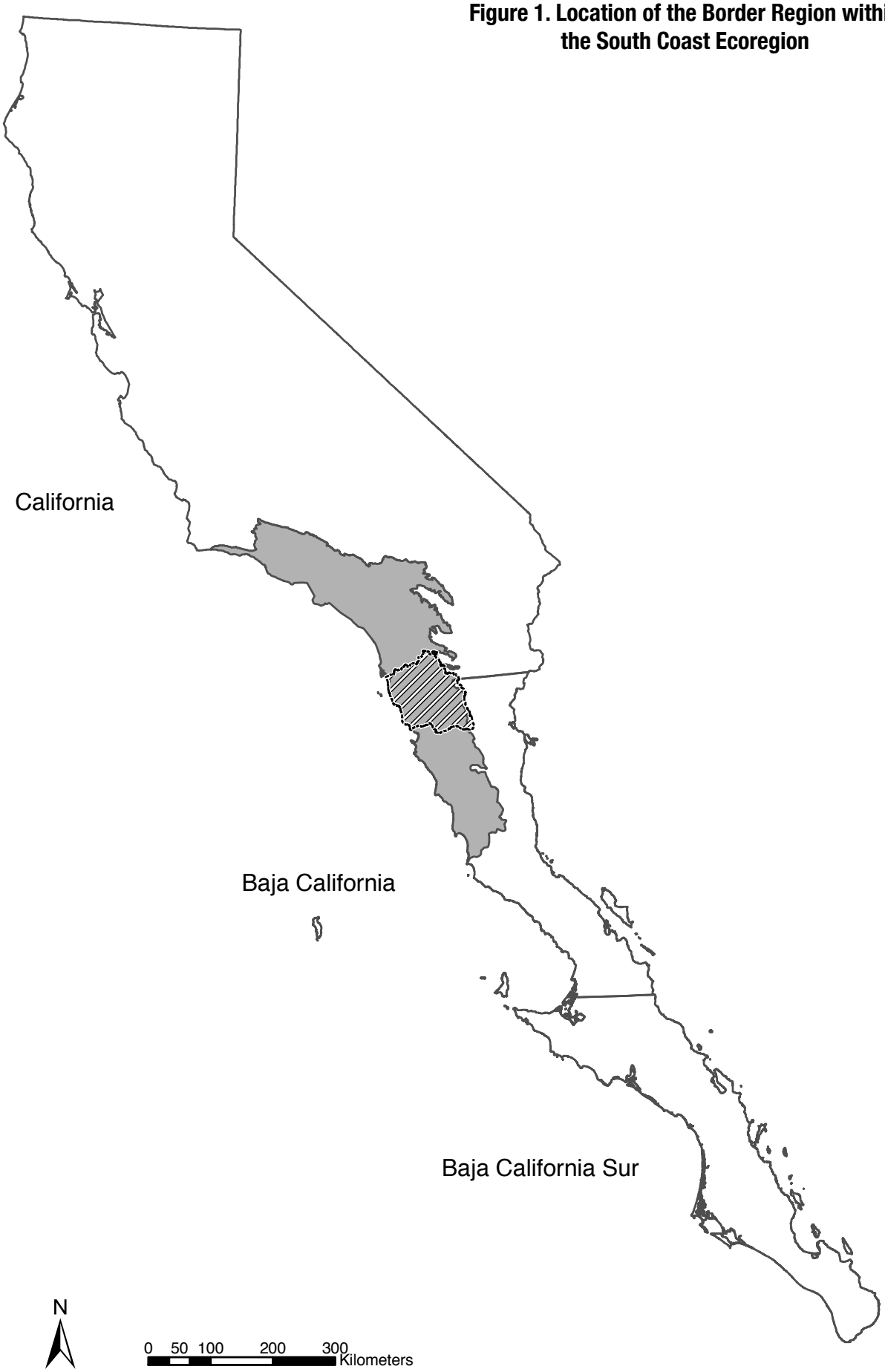
Figure 1. Location of the Border Region within the South Coast Ecoregion



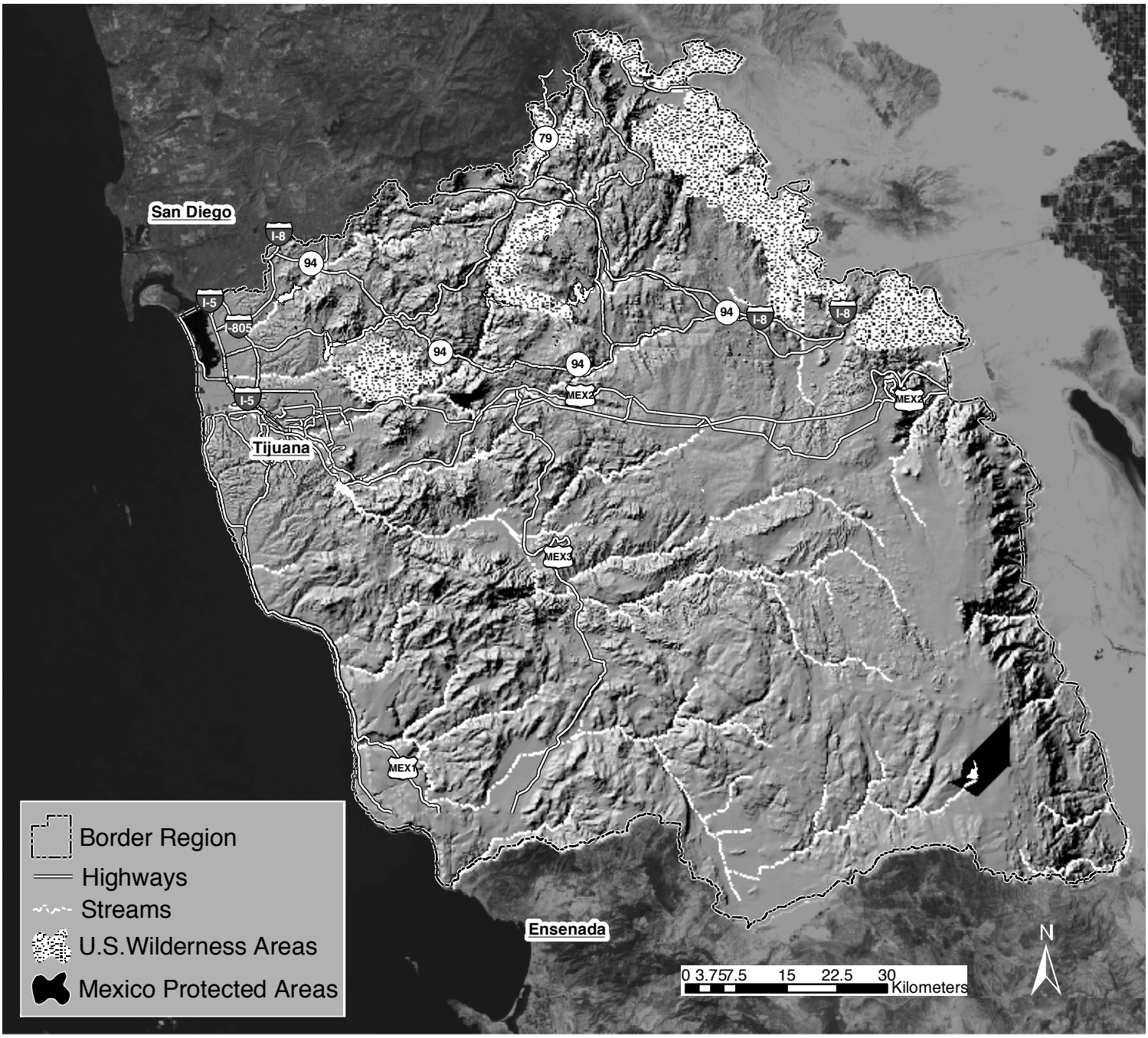


Figure 2. Border Region