

PARKS, PEACE, AND PARTNERSHIP: GLOBAL INITIATIVES IN TRANSBOUNDARY CONSERVATION

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On the Edge: Factors Influencing Conservation and Management in Two Border Mexican Parks

Angeles Mendoza Sammet and Michael S. Quinn

INTRODUCTION

The conservation and management of migratory wildlife and ecosystems that extend across North America requires cooperation among Mexico, Canada, and the United States. Political structures have been created to address transboundary conservation issues and/or foster specific goals. An example of tri-lateral cooperation is the Trilateral Committee for Wildlife and Ecosystem Conservation and Management (TCWECM), which addresses, among other issues, the preservation of migratory and shared species and the management of biodiversity and ecosystems (IBIP 2007). An example of bi-lateral cooperation is the program Wildlife Without Borders (U.S.A.-Mexico), which fosters capacity-building for management of natural resources in Mexico (USFWS 2007c).

Despite cooperative initiatives and resource allocations, the populations of endangered species in Mexico, and of migratory species that cross

international borders within North America, continue to be imperiled (e.g., AP 2007). The national systems of protected areas play a key role in the conservation of biodiversity (SEMARNAP n.d.; Parks Canada 2007). International parks such as the Waterton-Glacier International Peace Park are a tool to ensure protection of ecosystems and wildlife that span national borders. Although there are no international parks along the U.S.A.-Mexico border, since the 1930s there has been an initiative to create an international park with the Big Bend National Park (U.S.A.) and the Cañón de Santa Elena-Maderas del Carmen areas (Mexico). Differences in political priorities on both sides of the border kept the plan on hold until 2009, when the two governments expressed the intention to strengthen cooperation for conservation of ecosystems along that part of the border (LoBello 2007; U.S. Department of the Interior 2009). In 2010, the U.S. and Mexican governments agreed to pursue nomination of the area as a *natural area of bi-national interest*. Despite the absence of joint management of U.S.-Mexico border ecosystems, there is ongoing cooperation among protected areas agencies and staff on both sides of the border to share information and resources (Chester and Sifford, this volume).

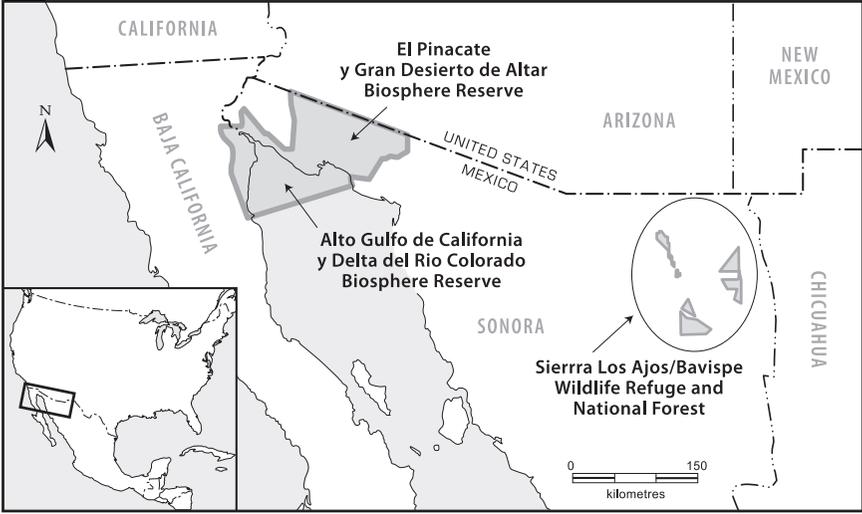
The continuing decline in populations of (and habitat quality for) migratory and endangered species suggests a need to examine the status of protected areas and international agreements as effective tools to protect biodiversity. Therefore, it is worth asking what factors are influencing the success of conservation and park management. Presuming that effective management results in effective conservation, the objective of this paper is to determine the main factors that influence park management and conservation of species of interest for North America using two Mexican border parks as case studies: El Pinacate y Gran Desierto de Altar Biosphere Reserve (Pinacate, hereafter) and Sierra de los Ajos Bavispe National Forest Reserve and Wildlife Refuge (Ajos, hereafter).

Six clusters of indicators have been used by Kaufmann et al. (1999) to measure governance effectiveness and study the consequences of governance on development. We employ those clusters to discuss how the factors influence conservation and management in the two border parks. These clusters include:

- *Voice and accountability*: aspects of the political process, civil liberties, political rights, citizens' ability to participate in the selection of governments, and independence of the media;
- *Political instability and violence*: perception of the likelihood of government destabilization by unconstitutional or violent means;
- *Government effectiveness*: quality of public service provision and bureaucracy, competence of public servants, independence of public service from political pressures, and credibility of government's commitment to policies;
- *Regulatory burden*: perception of burdens imposed by excessive regulation and incidence of unfriendly policies, controls, or supervision;
- *Rule of law*: confidence in, and abiding by, the rules of society, crime, enforceability, and effectiveness and predictability of the judiciary; and
- *Graft*: corruption, lack of respect for the rules that govern interactions.

METHODS

This study relied on case studies, interviews with fifteen key informants, literature and document reviews, and direct observations within the parks. The case studies were two Mexican parks located along the U.S.A.–Mexican border, in the State of Sonora: Pinacate y Gran Desierto de Altar Biosphere Reserve and Sierra de los Ajos-Bavispe National Forest Reserve and Wildlife Refuge (Map 1).



MAP 1. EL PINACATE Y GRAN DESIERTO DEL VIZCAINO BIOSPHERE RESERVE AND SIERRA DE LOS AJOS-BAVISPE NATIONAL FOREST RESERVE AND WILDLIFE REFUGE.

Both parks are included in a research project on management effectiveness carried out by one of the authors (Mendoza, unpublished). Two acronyms in this document are very similar, although they correspond to different agencies. SEMANAP is the Secretaría del Medio Ambiente, Recursos Naturales y Pesca (Secretariat of the Environment, Natural Resources and Fisheries), and it was one of the government's secretariats during the presidential administration of 1994–2000. The following presidential administration (2000–2006) removed fisheries, and the secretariat continued just as SEMARNAT or Secretaría del Medio Ambiente y Recursos Naturales (Secretariat of the Environment and Natural Resources). Together with SEMARNAT, the executive created the Comisión Nacional de Areas Naturales Protegidas or CONANP (National Commission of Natural Protected Areas) as a decentralized agency accountable to SEMARNAT and responsible for the national system of protected areas.

Pinacate was created by a presidential decree on June 10, 1983. El Pinacate is considered a consolidated protected area. It is located on the northwest end of the state, on one of the roughest parts of the Sonoran Desert (Fig. 1). It has an area of 714,556 hectares. Its geological diversity includes sand dunes and numerous craters and landforms of volcanic origin. The vegetation is composed of 560 vascular species, including xerophilic plants and shrubs. Its biodiversity includes approximately 184 species of birds, forty-two reptile species, four amphibian species, and two native freshwater fish species. Pinacate contains archaeological remains dating from the early occupation of America. It is also a place of cultural and spiritual value for the Pápago Indians (CONANP 2007; SEMARNAP 1995).

Sierra de los Ajos Bavispe National Forest Reserve and Area for Protection of Flora and Fauna, or Ajos, was created by a presidential decree on June 30, 1936 (Fig. 2); however, it remained without management until 1997. In 1996, it was recognized among the twenty-five priority protected areas. The next year it was provided with a management team for the first time. It is located in the northeast portion of the state of Sonora and is composed of five units that are spread among five mountain ranges in the state. Ajos is a source of two rivers of national importance (Sonora River and Yaqui River), and one of international importance (San Pedro River). It has an area of 184,776 hectares and contains various landforms, from riparian valleys to mountains. The vegetation varies from semi-arid shrubs, to grasslands, to pine-oak mixed forest. There are an estimated 1,234 species of vascular plants, 448 species of vertebrates, and 156 species of butterflies. Ajos is a stepping stone for the Monarch butterfly on its migration to southern Mexico (SEMARNAP, unpublished).

Ajos and Pinacate provide insight into the issues faced by parks in different stages of consolidation. Several municipalities overlap both parks and have jurisdiction over sections of each. Pinacate lies within two municipalities: Puerto Peñasco and Plutarco Elías Calles. Another municipality, San Luis Río Colorado, is influenced by the park. Ajos lies within the boundaries of four municipalities: Bacoachi, Cananea, Fronteras, and Nacoziari (SEMARNAP 1995, unpublished).

The two parks were chosen as case studies for the following reasons:

- Location in the same state;
- Existence of a management plan;
- Presence of migratory and/or species of common concern (IBIP 2003, 2007);
- Presence of species included in official lists of imperiled;
- Recognition of important bird conservation areas (CONABIO 2004, 2007); and
- Cooperation with parks and organizations in the U.S.A.

To determine the factors that influence management and conservation effectiveness, we used a pluri-dimensional model of governance interactions modified from Mendoza and Thompson (2005). The factors influencing conservation and management are the driving forces (facilitating positive outcomes), barriers (impeding positive outcomes), and ambivalent forces (both facilitating and impeding positive outcomes) that affect the achievement of desired conservation and protected area (PA) management outcomes. Examples of factors include: stakeholders, interests, statutes, or codes of conduct. The term 'stakeholder' refers to individuals and formal or informal organizations that have common interests and/or goals. The model was used to identify relationships the park has in four dimensions: regulatory, administrative, geographical/economic, and social (e.g., park and local communities). These dimensions represent four types of governance: national, economic, environmental, and protected areas (Fig. 3). The relationships are used to identify factors at five levels: internal, local, regional, national, and international. The terms 'park' and 'protected area' are used interchangeably.



FIG. 1. EL PINACATE Y GRAN DESIERTO DEL VIZCAINO BIOSPHERE RESERVE (A. MENDOZA SAMMET).



FIG. 2. SIERRA DE LOS AJOS-BAVISPE NATIONAL FOREST RESERVE AND WILDLIFE REFUGE (A. MENDOZA SAMMET).

RESULTS

Species

The two parks have a rich biodiversity that includes several species listed in Mexico, Canada, and the U.S.A. within various categories of protection. The management plans report species listed as threatened or endangered (SEMARNAT 2002) within various categories of protection (Table 1). Also, they have additional species reported by the National Commission of Biodiversity (CONABIO 2004) or by park staff. The Ajos management plan reports fifty-nine species and we added another six based on their status in the U.S.A. and Canada: Bald Eagle (*Haliaeetus leucocephalus*), Burrowing Owl (*Athene cunicularia*), jaguar (*Panthera onca*), beaver (*Castor canadensis*), and black-tailed prairie dog (*Cynomys ludovicianus*). Additionally, Ajos is along the migration route of Monarch butterfly (*Danaus plexippus*), which is observed in the park. Pinacate's management plan reports forty-eight species and we added Peregrine Falcon (*Falco peregrinus*).

Together, Pinacate and Ajos have sixteen species of concern in Canada, the U.S.A., or both, plus two birds of importance in Mexico (Table 2). Some of these species, such as the black bear (*Ursus americanus*), beaver, river otter (*Lontra canadensis*), black-tailed prairie dog, and Burrowing Owl are endangered and have a very limited distribution in Mexico. The status of the Burrowing Owl is not known in Mexico, so the official norm lists only an insular subspecies.

Table 1. Species listed within protection categories. Some groups were not reported in management plans.

	<i>Ajos</i>	<i>Pinacate</i>
Mammals	5	5
Birds	18	15
Reptiles / amphibians	28	21
Fish	–	4
Insects	1	–
Plants	7	3

Source: SEMARNAP 1995, SEMARNAP n.d.

Table 2. Number of Mexican, U.S.A., and Canadian listed species found in Pinacate and Ajos.

	<i>Endangered</i>	<i>Threatened</i>	<i>Species of Concern</i>
Canada	2	1	4
United States	8	3	0
Mexico	7	4	5*

Source: SEMARNAT 2002; EC 2007; USFWS 2007a.

* For Mexico, “species of concern” includes species subjected to special protection. The occurrence of species in the parks is as reported by CONABIO (2004, 2007) and the corresponding management plans (SEMARNAP 1995, SEMARNAT unpublished).

Factors

The relationships of the park along the four dimensions highlighted fifty-seven influential factors (excluding repeated ones), most of them represented by a particular stakeholder, such as a state secretariat (Figs. 3, 4, and 5). The factors were organized into the four dimensions and five spatial levels (layers) from internal to international (Tables 3 to 6). The factors were also assigned a value according to how they influence each park’s conservation and management outcomes, according to the experience of each park’s staff. The values are as follows: facilitates achievement of goals (+), hinders achievement (–), mixed, i.e., both facilitates and hinders achievement (+/–), not applicable to the park (0), and not a significant influence at the moment (Ø). The Society for Conservation of Pinacate is an example of a factor that is not significant at the moment. The organization had been influential but their presence in the area diminished because of lack of momentum.

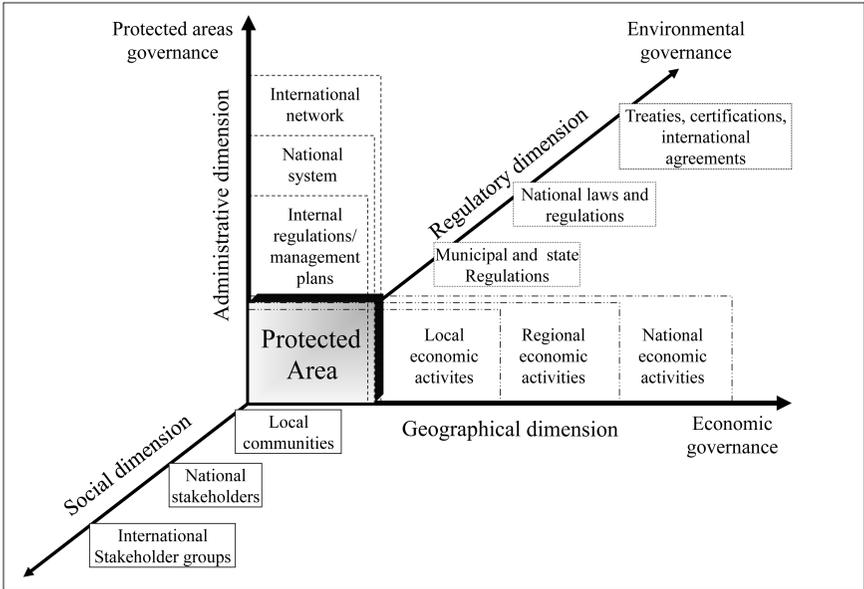


FIG. 3. PLURI-DIMENSIONAL GOVERNANCE MODEL FOR PROTECTED AREAS (MODIFIED FROM MENDOZA AND THOMPSON 2005).

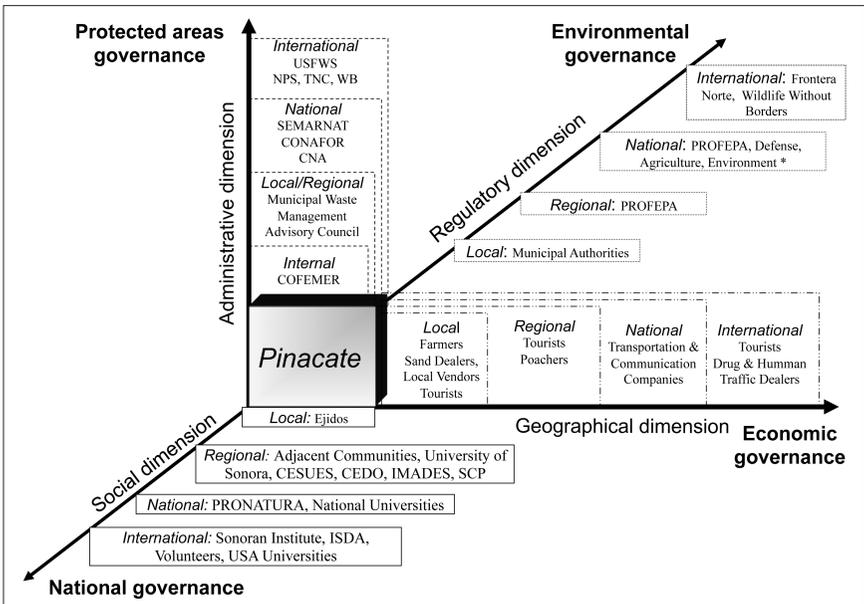


FIG. 4. FACTORS AND STAKEHOLDERS INFLUENCING MANAGEMENT AND CONSERVATION OUTCOMES FOR PINACATE.

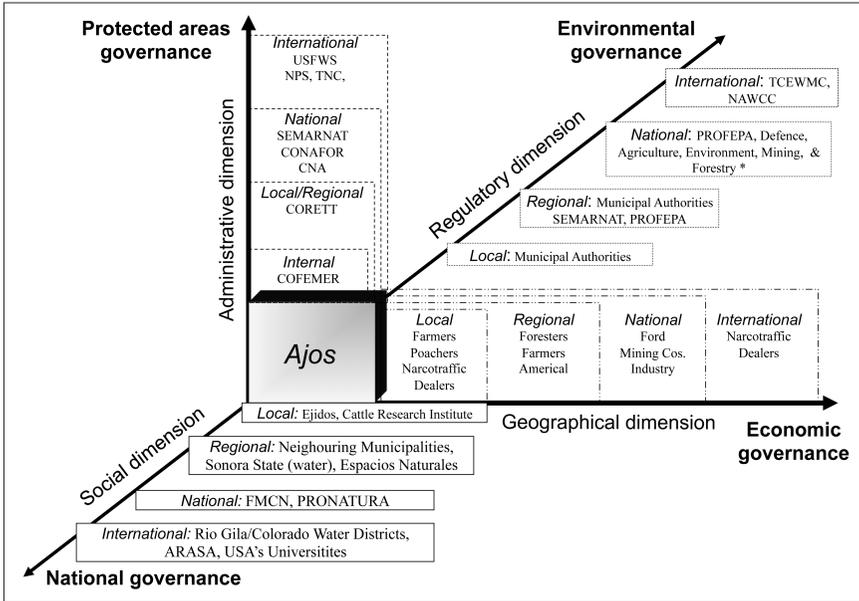


FIG. 5. FACTORS AND STAKEHOLDERS INFLUENCING MANAGEMENT AND CONSERVATION OUTCOMES FOR AJOS.

The most consistent facilitating influence on park management and conservation came from the international factors. International factors were positive influences in at least one of the parks in all four dimensions (Table 3). National factors were less consistent (Tables 3 to 6), but showed strong positive influence in the social dimension (Table 6). Regional factors also were strongly facilitative in the social dimension (Table 6), but mixed in other dimensions (Tables 3 to 6). In the administrative and regulatory dimensions, there are two types of governmental organizations: secretariats and national commissions. Secretariats are equivalent to federal ministries in Canada and the U.S.A. National commissions are independent federal agencies, although they are still considered part of the structure of a secretariat.

Table 3. *Administrative dimension factors* influencing conservation and management outcomes in two Mexican border parks. Influences include: facilitates achievement of goals (+), hinders achievement (-), mixed, i.e., both facilitates and hinders achievement (+/-), not applicable (0), and not a significant influence at the moment (\emptyset).

	<i>Influence</i>	
	Pinacate	Ajos
<i>International</i>		
USA agencies	+	+
World Bank	+	
The Nature Conservancy	+	+
<i>National</i>		
Secretariat of the Environment	-	-
National Commission of Natural Protected Areas	+/-	+/-
National Forestry Commission	\emptyset	-
National Water Commission	+/-	+/-
<i>Regional/local</i>		
Municipal Waste Management Authorities	-	
Advisory Council	\emptyset	\emptyset
Land Tenure Regulation Commission	-	-
<i>Internal</i>		
Federal Commission for Regulating Improvement	-	-

Table 4. *Regulatory dimension factors* influencing conservation and management outcomes in two Mexican border parks. Influences include: facilitates achievement of goals (+), hinders achievement (-), mixed, i.e., both facilitates and hinders achievement (+/-), not applicable (0), and not a significant influence at the moment (∅).

	<i>Influence</i>	
	Pinacate	Ajos
<i>International</i>		
Trilateral Committee for Wildlife and Ecosystem Conservation and Management (TCWECM)	+	+
North American Wetlands Conservation Committee	o	+
Frontera Norte	+	∅
Wildlife Without Borders	+	∅
<i>National</i>		
Environment Prosecutor (PROFEPA)	+/-	+/-
Secretariat of the Environment	+/-	+/-
Secretary of Communications and Transport	+/-	o
Secretariat of Agriculture	+/-	+/-
Secretariat of Economy	+/-	+/-
Secretariat of National Defense	+/-	+/-
National Forestry Commission	o	-
National Water Commission	o	-
National Biodiversity Commission	+	+

The regulatory dimension was notably mixed, with most factors showing both a facilitating and impeding effect (Table 4). The geographic/economic factors were predominately impeding the management of these trans-boundary conservation units (Table 5). Finally, the social dimension was largely facilitating across the three highest levels: international, national, and regional (Table 6).

Table 5. *Geographic/Economic dimension factors* influencing conservation and management outcomes in two Mexican border parks. Influences include: facilitates achievement of goals (+), hinders achievement (-), mixed, i.e., both facilitates and hinders achievement (+/-), not applicable (0), and not a significant influence at the moment (\emptyset).

	<i>Influence</i>	
	Pinacate	Ajos
<i>International</i>		
Tourists	-	\emptyset
Narcotics traffickers	-	-
<i>National</i>		
Telecommunication companies	-	0
Transportation sector	-	0
Ford	0	+
Mining companies	0	-
Heavy industry	0	-
<i>Regional</i>		
Tourists	+/-	0
Farmers	0	-
Americal (company)	0	-
Poachers	-	-
<i>Local</i>		
Farmers	-	-
Sand & rock extraction companies	-	-
Local vendors	-	0
Tourists	-	0

Table 6. *Social dimension factors* influencing conservation and management outcomes in two Mexican border parks. Influences include: facilitates achievement of goals (+), hinders achievement (-), mixed, i.e., both facilitates and hinders achievement (+/-), not applicable (0), and not a significant influence at the moment (Ø).

	<i>Influence</i>	
	Pinacate	Ajos
<i>International</i>		
USA research institutes	+	+
USA universities	+	+
USA border water authorities	o	+
Volunteers	+	Ø
Asociación Regional Ambientalista Sonora–Arizona	Ø	+
International Sonoran Desert Alliance	+	-
<i>National</i>		
National universities	+	+
Pronatura	+	Ø
Mexican Fund for Conservation of Nature	Ø	+
<i>Regional</i>		
Institute of Environment and Sustainable Development	+	Ø
State academic institutions	+	+
Society for Conservation of Pinacate	Ø	o
Center for Studies of Oceans and Deserts	+	o
Natural Spaces	o	+
Water users	o	Ø
<i>Local</i>		
Research Institute– Secretariat of Agriculture	o	-
Neighbouring municipalities	+/-	-
<i>Internal</i>		
Ejidos	+/-	o

State Secretariats and Commissions

The presence in both Pinacate and Ajos of species and ecosystems of concern for North America puts the parks among the priority-protected areas in Mexico. In addition, their location along the international boundary makes them areas of interests for various international stakeholders, especially in the U.S.A. Each of the fifty-seven factors influences parks' outcomes to a greater or lesser degree, although some are specific to one park (Tables 3 to 6). Some factors can have different roles at different levels and dimensions. Thus, those factors can influence conservation and management in different ways. Secretariats at the state level of government are a good example.

State secretariats can favour or hinder conservation and management. Through their regulatory role they can push for legal changes to promote sustainable development and reduce environmental impacts. Also, they can establish mechanisms to make inter-secretariat coordination more effective and efficient. At regional and local levels, secretariat offices fulfill administrative functions and have greater involvement on the implementation of programs. In the case of the two parks, management was affected by the lack of congruency among policies developed by different secretariats and their contradictory objectives. Ajos was the park more affected by the inefficient coordination between local and central offices of secretariats and commissions. At regional and local levels, the administrative role of secretariats' offices reflected problems in governance such as corruption, poor effectiveness, and excessive regulatory burden. Eight secretariats and one national commission are most relevant because the activities they regulate have a direct influence on the environment or on the design of regulatory or development policies. Therefore, their decisions and actions can favour or hinder conservation and management. Table 7 shows the areas of responsibility of the main secretariats and commissions. The following sections explain their influence on the parks.

Table 7. Secretariats and commissions influencing Mexican protected areas, relevant dependencies, and areas of responsibility. See Table 3 and text for full Spanish names.

Secretariat of Agriculture	Agriculture, cattle-farming, rural development, fisheries, and food supply
Secretariat of Communication and Transport	Communication infrastructure, transportation regulation, and road corridors
Secretariat of Economy	<i>Federal Commission of Regulatory Improvement</i>
	Mining and industry
	Approval of park management plans: verify objectives of management plans and do not interfere with economic development
Secretariat of External Affairs	International agreements
Secretariat of the Environment	<i>General Directorate of Environmental Risk and Impact</i>
	Natural resources and environment; environmental assessment process
	<i>General Directorate of Wildlife</i>
	Hunting, wildlife status, and species recovery
	<i>National Commission of Natural Protected Areas</i>
	Protected areas
	<i>National Forestry Commission</i>
	Forests
	<i>National Water Commission</i>
	Waters
	<i>Environment Prosecutor</i>
	Environmental protection, enforcement and prosecution
Secretariat of Social Development	<i>Land Tenure Regulation Commission</i>
	Land tenure
Secretariat of National Defense	Enforcement and vigilance
Secretariat of Tourism	Tourism activities and operators
National Biodiversity Commission	Knowledge, preservation, and use of biodiversity

Government Effectiveness and Regulatory Burden

The interactions each park has across different levels and dimensions create barriers that impede goal attainment. Poor outcomes result from deficiencies in: interpretation, implementation, use of resources, follow-up, and enforcement. To be efficient and solve most of the issues affecting parks, there is a need for government effectiveness at three levels: local, inter-agency, and inter-secretariat.

- *Local*: interaction of park staff with other dependencies to solve local problems, for instance, dispersion of municipal waste into park lands because of improper waste management and disposal; and lack of awareness among local habitants and civil servants about the effects their activities have on the parks and the contribution of the parks to their quality of life, e.g., ecosystem services.
- *Intra-agency*: coordination and sharing of resources between the National Protected Areas Commission (CONANP) and each one of the other branches of SEMARNAT, i.e., lack of coordination between parks and the General Directorate of Wildlife to monitor listed species or implement recovery programs, and parks and the Forestry Commission (Comision Nacional Forestal, CONAFOR) to solve irregularities in forestry practices.
- *Inter-secretariat*: coordination of high-level staff from CONANP and SEMARNAT with peers from other secretariats to negotiate priorities when modifying federal laws or setting objectives for policies or programs that may negatively affect ecosystems or biodiversity, for instance:
 - changes to the laws of the environment (Ley General del Equilibrio Ecologico y Proteccion al Ambiente, LGEEPA) and forestry (General Law of Sustainable Forest Development) that removed the need to assess forestry impacts;
 - antagonistic goals of policies promoted by the Secretariat of

Agriculture (Secretaria de Agricultura, Ganaderia, Desarrollo Rural, Pesca y Alimentacion, SAGARPA);

- unclear ownership of lands inside and around the parks, which is a responsibility of the Secretariat of Social Development (Secretaria de Desarrollo Social) through the Tenure Regulation Commission (Comision para la Regularizacion de la Tenencia de la Tierra); and
- prevalence of mining rights that overshadow conservation needs, which is a responsibility of the Secretariat of Economy (Secretaria de Economia, SE).

CONANP staff feared increasing habitat fragmentation, poaching, and illegal hunting because of forest fragmentation that resulted from management/development initiatives of other stakeholders. Likewise, promoting extensive grazing and growth of non-native grasses creates conflicts with the protection of native grasslands and associated species such as prairie dog and Burrowing Owl. Particularly in Ajos, unclear land ownership was a prime hindering factor. Some people had titles for land inside the park that were issued long after the park was created, which is a clear sign of lack of coordination across levels and dimensions of the matrix of relationships.

Protected Areas Governance and Management

Lack of voice and accountability diminished staff motivation to innovate or improve effectiveness. Interviewees feared personal repercussions for expressing opinions about aspects requiring improvement. Moreover, staff felt unsupported by higher authorities when trying to realize the implementation of objectives and faced opposition from influential groups. Staff believed this caused the removal of two park directors. Staff also felt left out of important decision-making processes and perceived a preference for economic interests over conservation priorities or scientific facts. Through its commissions or directorates, the Secretariat of the Environment, SEMARNAT, is the responsible authority in matters of environment and natural resources, including enforcement, protected areas, and wildlife.

One of the main factors that hindered management efficiency was the workload of park staff. A basic management team has five people who are assigned responsibilities that overlap those of other jurisdictions and diverted staff time and resources. Although the Secretariats of Social Development and Agriculture are responsible for social and rural development respectively, CONANP's work plan for 2001–2006 made protected areas staff responsible for promoting Programs for Sustainable Development (Programas de Desarrollo Sostenible, PRODERS) among internal and surrounding communities (CONANP 2001). One staff member at the park had been promoting three PRODERS without much success:

- nurseries for palo fierro (*Olneya tesota*), a tree subjected to special protection found in Pinacate and used for carving handcrafts;
- agricultural practices or restoration of grazing lands; and
- ecotourism.

Since the administration of President Vicente Fox, there has been a program of presidential targets to improve areas such as coordination among different secretariats. CONANP and SEMARNAT have to report how coordination occurs. The results are not evident yet. So far, the indicators used by CONANP have dealt more with processes or inputs rather than outcomes (CONANP 2006).

Sponsorships from private companies and partnerships with international organizations such as The Nature Conservancy are helping parks improve management and conservation. Nevertheless, their reporting requirements contribute to the regulatory burden. Staff felt there was excessive reporting required for partners, sponsors, park authorities, and other government departments. This has to be added to the complexity of administrative processes and the bureaucracy characterizing inter-agency procedures. Also, some problems have resulted from lack of clarity regarding the benefits and conditions for private sponsorship.

Rule of Law

Mexico has laws to ensure effective and efficient management of natural resources. Protected areas should be an example of places where citizens abide by the rules. Nevertheless, both parks have been affected by inappropriate public behaviour and inefficient vigilance and enforcement. Creating the position of an environmental prosecutor (Procuraduría Federal de Protección al Ambiente, PROFEPA) responsible for vigilance, inspection, enforcement, and prosecution was well-intentioned and may have sought to use resources more efficiently. However, limitations on environmental prosecutor resources, training, and staff, in addition to the remoteness and vastness of park lands, have resulted in insufficient vigilance and enforcement that favours destruction of habitat and biodiversity. The insufficient number of inspectors and the bureaucracy involved in processing violators promotes the proliferation of illegal uses. Moreover, infringers are charged fines but there are no provisions to repair or mitigate damages. Common problems in parks include extraction of flora and fauna and illegal hunting. In Ajos, for example, black bears have been killed to get gallbladders for the illicit market in animal parts. Other problems involve local or nearby communities that use park lands for illegal grazing or farming. Some community members have helped in Pinacate by serving as volunteer guards or working on some restoration projects. Parks can employ local people as labour for specific projects, which are funded through temporary employment funds.

There is no equivalent of a park warden or park ranger service in Mexico. CONANP staff lacks capacity and training to deal with crime or violators, so park authorities or staff may request the assistance of local or federal police. Commonly the Environmental Prosecutor (PROFEPA) has to ask for the intervention of the military (Secretaría de la Defensa Nacional) for dealing with crime inside protected areas. In Ajos, violations to law included the use of remote areas by drug gangs to grow marijuana, illegal hunting, and use of park lands by local people for cattle-grazing. In Pinacate, violations included use of remote areas by crime groups to move illegal immigrants and drugs across the U.S.A.-Mexico border. The military helps fight illegal activities, although the way it conducts its operations generates environmental impacts, for instance, clearing areas for

camps, use of heavy machines, unauthorized hunting, and inappropriate waste disposal.

Ultra Vires Activities

There were complaints of corruption observed at various levels. Staff at Ajos commented that some municipal employees: favoured industrial activities by obstructing conservation activities, received bribes to skip steps on approvals, favoured friends, or altered results to get petitions approved. Some of the complaints involved functionaries within SEMARNAT. Finally, there were also complaints of military authorities protecting the interests of drug growers and dealers inside parks by simulating operations to destroy crops and capture violators.

Corporate Governance

One of the obstacles hindering conservation and effective management stems from poor corporate governance and social responsibility. Corporate behaviour can have great repercussions on protected areas and biodiversity. Companies that strive to show good corporate social responsibility and improve environmental management of their operations will benefit themselves and their surroundings. The Ford Foundation, for instance, provided funds for a nursery in Ajos to grow native trees.

On the other hand, companies that focus on the bottom line are prone to use bribery to get approvals. Mining companies in the area have a bad reputation because of corruption, illegal use of protected lands, damage to wildlife habitat, and effects on human health. Other extractive industries have behaved similarly. There were complaints that mining companies paid people to threaten environmental leaders and spread rumours against the park and the proposed annexations.

Management of Natural Resources

Wildlife Management

The National Biodiversity Commission (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad) is the institution leading

conservation of biodiversity in Mexico. It distributes federal funds to support projects that generate information about Mexico's biodiversity. Its functions include compiling information about national biodiversity and ecosystems, identifying priority areas for conservation, and participating in the development of policies for protection of ecosystems and species.

The Trilateral Committee for Wildlife and Ecosystem Conservation and Management (TCWECM) have established working tables for species of concern (IBIP 2007), although specific actions have not been taken. CONANP took over jurisdiction on endangered species in 2009. Prior to that, the Dirección General de Vida Silvestre (DGVS) was responsible for endangered species and their recovery plans (SEMARNAT 2007b). The DGVS prepared management plans for some of the species such as the prairie dog (n.d.), Golden Eagle (*Aquila chrysaetos*) (1999), black bear (1999), and bighorn sheep (*Ovis Canadensis*) (2000); however, they have not yet been implemented. Park staff had no knowledge of the programs nor had they been involved in their design. Staff was not involved in the TCWECM working tables either. Interviews with staff in other Mexican parks (Mendoza unpublished) revealed a similar situation. For instance, the Piping Plover is endangered in Canada, the U.S.A., and Mexico. Nevertheless, there were no actions focussing on this species. Political instability and conflicts with communities interested in logging has obstructed TCWECM initiatives and efforts to make the Monarch Butterfly Biosphere Reserve work. At Pinacate, the two primary causes of wildlife mortality have been road kills and poaching. Staff commented that farmers continue killing wildlife, especially Golden Eagles and jaguars because of the belief that the species attack cattle.

Forest Management

The forest in Ajos has been subject to a natural fire regime, which makes it a good reference system for forest management in other jurisdictions that have implemented fire control. Ajos also has species of economic value, so efficient forest management is a must for maintaining ecosystem and watershed health. Pinacate staff had concerns about overexploitation of palo fierro (iron wood). In Ajos, staff commented on various issues that reduced harmonization of Forestry Commission goals and activities with those of the park:

- reforestation with exotic and non-native tree species;
- approval of logging without follow-up on licences or established quotes;
- extraction of tree species different from those authorized;
- lack of programs for training on control of forest fires; and
- lack of support toward local initiatives compatible with conservation, e.g., establishing Christmas tree plantations.

Water and Watershed Management

Water is increasingly scarce in Mexico, especially in the northwest. The geographic management units composing Ajos, and the proposed annexations, are a significant source of water for the state and of great interest to industry. Staff said the park land base provides nearly 70 per cent of the state's water requirements. The reserve and proposed annexations are of interest for water users on the U.S. side of the border, too. The Rio San Pedro, which borders habitat for prairie dog, Burrowing Owl, and native grasses, is a tributary of the U.S.A.'s Gila River, itself a tributary of the Colorado River. A U.S. proposal to protect part of the San Pedro River watershed and expand Ajos was presented to the Mexican authorities. Nevertheless, the proposal has not been implemented.

Economic Policy

The Secretariat of Economy (SE) has a great influence in park management. Its Federal Commission of Regulatory Improvement (Comisión Federal de Mejora Regulatoria) reviews and approves park management plans and regulations. Parks experience regulatory burden because this process is usually restrictive and time-consuming. For instance, the Ajos management plan has been in progress since 1999 and at the time of writing this chapter (May 2012) it has not yet been approved. Staff in both parks commented that they were not allowed to introduce into the management plans new regulations considered necessary to achieve conservation of species or ecosystems. Neither could they include conservation or

management actions that, in the opinion of the reviewers, might affect economic activities. SE is also responsible for mining and industry, two activities that generate most of the environmental effects in the region. Staff in headquarters commented on the inappropriate control of mining and industry effects on ecosystems and human health.

Management of Mining and Industrial Activities

Legal and illegal extraction of mineral resources was a problem in both parks. In the case of Pinacate, companies extract sand and/or rock for construction, disrupting flora and fauna. Some extraction of sand was authorized for upgrading the highway; however, restoration was not evident afterward. Often people that were awarded permits to extract sand from one site but extracted it from another. In one case, a company extracted sand from the river, causing a drop in water levels. This drawdown endangered aquatic species, especially the pupo del desierto (*Cyprinodon macularius*), an endemic fish at risk of extinction.

There are noticeable effects from these activities in the Ajos area, both on ecosystems and human populations. Local people have a high incidence of respiratory diseases and cancer, and the forests suffer from acid deposition. Mining companies and other industries build reservoirs to contain wastewater. However, there is no water treatment and the reservoirs are abandoned when they fill up, leaving water quality at risk. Also, building and mining zones are left abandoned without mitigation of impacts.

Agricultural Policies

Farming, especially cattle-grazing, was the other economic activity that negatively affected conservation and management. One reason for agricultural-park management conflict was the incompatibility of actions to implement agricultural policies with the conservation needs of parks. This affected particularly the grasslands and the remaining habitat for prairie dog and Burrowing Owl. Noteworthy effects are the following:

- experimentation with genetically modified grasses that could change vegetation composition just outside the boundaries of the reserve;
- promotion of extensive grazing on zones of low capacity which reduces wildlife habitat and contributes to land degradation;
- promotion of exotic grasses that displace native grasses; and
- changes in floristic composition because of invasion of non-palatable species and soil compaction due to overgrazing.

Another source of conflict between agricultural and park management was the effect of inappropriate practices used by farmers and cattle-growers, sometimes driven by ignorance and sometimes driven by personal gain, including: unauthorized use of park lands for growing crops or cattle-grazing, illegal acquisition of titles for park lands, and disregard of grazing zoning and quotas.

Tourism Management

Tourism is not a significant source of income for the parks. Pinacate had around 6,500 visitors in one year, which staff considered low visitation. This park has some day-use facilities. Common problems with tourism were damage to facilities, improper garbage disposal, inappropriate human waste disposal, damage to flora and fauna, and damage to geological resources. In addition, some local residents established roadside food stands whose main effect would be inappropriate garbage disposal and damage to soil and vegetation from unregulated parking. Some local inhabitants would use the park for racing with trucks or cars. Ajos was not open to the public; nevertheless, local people entered the park for various purposes. As a result, garbage from occasional visitors and visitor-related damage to flora or fauna can still be found.

In 2002, changes in the Federal Law of Rights enabled park authorities to collect fees for the recreational use of natural marine and terrestrial resources. Nevertheless, it was not until 2006 that CONANP issued the Conservation Pass, an annual park pass that gives a person the right to

visit any of the federal protected areas as many times as desired 250 pesos (CONANP 2007). No information was found regarding plans to monitor visitor-related impacts in protected areas.

Environmental Impact Assessment (EIA) Process

The work of the General Directorate of Environmental Impact and Risk (Dirección General de Impacto y Riesgo Ambiental, DGIRA) could be one of the main forces to control and minimize the impacts from human activities on human populations and on park biodiversity and ecosystems. However, irregularities in the environmental assessment process reduce EIA's usefulness as a tool for decision-making. EIA reports for approved projects submitted to the parks were of poor quality (Mendoza 2004). Some of the flaws included:

- alteration of park boundaries and location of proposed activities;
- analysis of impacts based mainly on outdated literature search;
- inappropriate sampling;
- lack of field work;
- lack of – or inappropriate – mitigation measures;
- neglectful treatment of relevant environmental impacts; and
- insufficient time for park staff to review EIA report and submit comments.

Mexico's environmental law does not have provisions for assessing the environmental impacts of laws, programs, policies, or projects. Consequently, environmental assessments are not sufficient to achieve effective management of environmental impacts.

Other Factors

Foreign Assistance

Lack of funding and training are ongoing issues. Ajos staff commented that most of the funds available nationally were destined for parks with tropical forests, affecting parks with other vegetation types. Having protected areas across the international border is one of the main factors that favours conservation and management in the region. The relationships that Mexican park staff have established with their American peers facilitates information sharing and access to resources from agencies such as the U.S. National Park Service (NPS). Pinacate established cooperation with Organ Pipe Cactus National Monument in Arizona with which it shares resources for monitoring air quality and visibility. Ajos established cooperation with Chiricahua National Monument and Coronado National Memorial (both in Arizona) to address issues such as control of forest fires.

The U.S. Fish and Wildlife Service (USFWS) in Arizona is another important stakeholder that assists the border parks with technical knowledge and experience, and with funding options for capacity-building through programs like Wildlife Without Borders and the Program of the Committee for the North American Wetlands Conservation Act (USFWS 2007b). For instance, the Wildlife Without Borders grant program funds training of protected area managers (USFWS 2007c).

Pinacate was able to access funds provided by the World Bank and the program Frontera Norte (North Frontier), a U.S.A.-Mexico bilateral program. This program fosters cooperation in areas such as water, ecosystems, and biodiversity, and minimizing pollution from industrial activities (SEMARNAT 2007a).

The Nature Conservancy is an organization with significant influence in both parks. Its program “Parks in Peril” has provided funds to help consolidate both parks. Its tools, such as the site consolidation scorecard and the Five-S Framework, help organize management and measure success. Nevertheless, TNC’s management tools focus on conservation targets and reporting requirements are very different from SEMARNAT

requirements. This increases the regulatory burden for park managers and staff.

The Trilateral Committee for Wildlife and Ecosystem Conservation and Management favours information exchange on topics of common interest. Commonly, it is staff from the headquarters or other high-level staff who attend the meetings. However, failure to include lower-level agency staff, park staff, or outside experts reduces the effectiveness of the working groups of the Trilateral Committee. This lack of involvement causes slow information gathering, delayed implementation of adopted action plans, and reduced effectiveness.

Academic and research institutions from the U.S.A. contribute by generating knowledge about species or ecosystems. Pinacate had a good relationship with the International Sonoran Desert Alliance, a bi-national non-profit. At Ajos, the University of New Mexico conducted a study about jaguar and the University of Arizona researched prairie dog and associated bird species. Foreign volunteers have participated in research or monitoring activities. Additionally, both parks have had support from foreign non-governmental organizations. The relationships, however, are not regular and projects are transitory.

National Organizations

Academic and research institutions within Mexico also contribute to research. Institutions such as the University of Sonora, the Centre of Superior Studies of the State of Sonora (Centro de Estudios Superiores del Estado de Sonora), and the Centre for Studies of Deserts and Oceans (Centro de Estudios de Desiertos y Océanos) conducted research in Pinacate. The Institute of Ecology is an academic institution that promoted the designation of Pinacate as a biosphere reserve.

The failure of researchers to share results with park staff hinders management and conservation. Especially in Mexico, it is common to have students doing professional practice or thesis work in parks. However, parks do not always receive copies of the final documents. Also, research is often focussed on the researcher's interests rather than on the information needs of parks.

Different national governmental and non-governmental organizations (NGOs) help parks improve relationships with local communities through environmental education or other activities. Natural Spaces and the Regional Environmental Association Sonora-Arizona (Asociación Regional Ambientalista Sonora-Arizona or ARASA) were two NGOs that have collaborated with Ajos. ARASA was active in trying to neutralize rumours spread amongst local people that their land would be taken away for the park. In Pinacate, advocacy and public support for the park were expressed through the Society for Conservation of Pinacate (SCP), which involved people from the state and some of the academics that worked for the protected designation of the area. However, the society lost momentum a few years after the creation of the park.

In Ajos, the Mexican Fund for Conservation of Nature (Fondo Mexicano para la Conservación de la Naturaleza) and the Institute of Environment and Sustainable Development (Instituto de Medio Ambiente y Desarrollo Sostenible) have provided funds for projects. A national NGO, Pronatura, expressed interest in partnering with the park, although no projects have been created yet.

Species of Concern

Inclusion of species on the corresponding endangered species lists or among the species of concern in North America is the main driver to implement protection and recovery actions to improve their conservation status. Listing, however, is not a guarantee of conservation action. The Burrowing Owl is an example. Its status in Mexico is unknown and there are no programs for this species. To date, park staff in Mexico is not allowed to participate in research, just to coordinate it. In addition, there are no funds available for research or monitoring in parks, and staff is expected to recruit institutions interested in research. If that happens, the projects correspond primarily to academic interests.

CONCLUSIONS AND RECOMMENDATIONS

Whether a protected area is able to achieve its conservation and management objectives depends on a wide variety of factors. Pinacate y Gran Desierto de Altar Biosphere Reserve and Sierra de los Ajos-Bavispe National Forest Reserve and Wildlife Refuge are two case studies used in this chapter to analyze their interactions with stakeholders to identify the factors that have more influence on each park's ability to achieve its goals. A pluri-dimensional model of governance was used to organize each park's actors into four types of governance (protected areas, environmental, economic, and social) and four levels (local, regional, national, and international). The interrelationships across levels and types of governance highlighted fifty-seven factors that influence conservation and management effectiveness. A factor may act in different ways at various spatial levels and dimensions. Thus, it may influence park outcomes in different ways. For instance, municipalities are influential locally in their administrative role through the provision of services such as garbage collection. Similarly, a secretariat may have local influence in its administrative role when authorizing permits and may have national influence when it drafts laws or designs national policies and programs. Similarly, the same factor may influence outcomes in more than one way. For example, there may be good national regulations in place; however, their implementation locally may face challenges that reduce the regulations' effectiveness.

Although the National Commission of Natural Protected Areas (CONANP) is a decentralized agency, it is still subjected to the SEMARNAT. The secretariat still has a big influence on CONANP's outcomes because of its roles as regulatory entity (drafting laws and regulations, policy-making, and inter-secretariat coordination) and as authority responsible for the environmental assessment process. SEMARNAT is the authority that sees over the implementation of the environmental policy, so it should intervene if there are conflicts between conservation and development policies set by other secretariats. For example, the Secretariat of the Environment should assess areas where Secretariat of Agriculture programs and policies conflict with protected area management in these desert parks and seek to arrange program modifications in those areas

that guide development in a more harmonious manner with conservation goals.

Ineffective governance affects not only ecosystems and biodiversity but also human health and well-being. National agencies and regulators had an overall negative influence because of governance factors such as corruption, inefficient enforcement, and the dominance of economic interests. Lack of a strategic assessment of laws, policies, and programs propitiated conflicts among policies pursued by dependencies of the government who should cooperate to achieve sustainable development goals. In this case, the effects of poor governance are more evident at lower levels (local/regional) when policies are implemented and the corresponding actions result in environmental impacts on the human population, the environment, and biodiversity.

Several challenges impact park staff and their capacity for management effectiveness. One of the most significant issues is the lack of enforcement authority held by park staff. This means that when park staff discover legal violations they must rely on another level of authority for enforcement. Modelling many other nations' park law enforcement approaches – giving such authority to a trained and adequately staffed park warden service – would avoid delay, improve deterrence, and promote conservation. The current role of park staff in enforcement is also inefficiently structured, requiring reporting that burdens actual management time. While there is a need for accountability and information transmission, such needs should be balanced against staff time priorities to achieve conservation within the parks. Freeing staff time to conduct needed research directed toward answering management-related questions, along with granting staff authority to directly participate in research rather than just coordinate it, would contribute to building the knowledge base necessary for effective conservation within the parks. Just one example would be a population and habitat survey of Burrowing Owls, which are listed as sensitive species but cannot be managed in an information vacuum. Addressing staff capacity is a critical element of improving park management efficiency.

The location along the international border and the existence of shared natural resources, ecosystems, and species of concern increases

the opportunities of parks to access foreign aid. For both parks, foreign actors have a positive influence in achieving outcomes through sharing knowledge and resources (human and material). In addition, the international recognition of the scarcity and value of resources such as water and biodiversity is a factor that may promote positive changes in policies to achieve management and conservation goals. Tapping these external resources can be an important part of improving management effectiveness.

The following actions may help improve conservation and management of El Pinacate y Gran Desierto de Altar Biosphere and of Sierra de los Ajos Bavispe National Forest Reserve:

- Currently only senior staff and directors of CONANP participate on the so-called working tables of the Trilateral Committee for Wildlife and Ecosystem Conservation and Management (TCEWCM). These discussion tables are set to share knowledge and promote multi-lateral cooperation. Park staff are usually more knowledgeable of the needs and challenges to implement conservation policy, so getting park staff involved in these tables would contribute to improving the design of cooperative initiatives and would empower them to implement programs more effectively.
- The allocation of five staff as a management team for a park marks great progress, considering that before the creation of the CONANP there were practically no staff working in the parks. However, the number is not enough and park staff are getting overloaded by the regulatory burden from the different national authorities and the other sponsors they get individually (e.g., The Nature Conservancy). It is necessary to evaluate the effectiveness of administrative procedures to reduce the regulatory burden on staff and help improve their efficiency.
- The lack of financial resources dedicated to protected areas in Mexico results in a dearth of staff assigned to each park. Consequently, there is little capacity to conduct research. Park

staff are aware of the information needs, although there is not an official research agenda. Personnel carrying out research or monitoring normally work for a specific project and are not park staff. In addition, CONANP's policy has been to open PAs for people or institutions interested in conducting research. Both factors determine that whatever research is done responds to the interests of the researchers or funding institutions rather to the information needs to manage parks. Two actions would be beneficial for the parks:

- Allowing staff to participate in monitoring and research to ensure a direct link between research and park information needs. Ideally, each park should have allocated one or more research and/or monitoring positions for staff. PAs in the national system could be assigned a priority to get the positions. A starting point could be to create a position for a research coordinator per region. This person should be in charge of determining that the research that is carried out is consistent with the objectives and, if it is the case, that the results are directly applicable to management issues. This staff position could also coordinate with researchers and track information to ensure that each park receives copies of the data and/or information generated.
- Having a research agenda with priorities for each park and ensuring seed money to create a research fund for protected areas would empower PAs and CONANP to focus research on their respective conservation and management needs. This would not exclude opening parks to other projects not directed to that end. Establishing such a fund could make it easier to attract partners and donations for research.
- Although the initiatives arising from the TCEWCM are considered official commitments to collaborate, progress is slow and there is not enough information available on the

website to show the progress made and whether collaboration has been successful in improving the population status of the species of mutual concern or to reduce the threats they face. It is necessary to promote the adoption of mechanisms to evaluate the outcomes and to promote more accountability among the agencies participating in TCEWCM. This would create greater incentive to establish multi-lateral projects for the recovery of species of concern. Such projects should involve park staff from the three member countries as well as outside experts.

- In Mexico, it is necessary to change the mindset that a park warden service is a cost that can be spared rather than an investment for ensuring conservation of biodiversity and maintaining the ecological integrity of ecosystems. To make enforcement and vigilance economic, effective, and efficient, park wardens need to have some prosecutorial authority and responsibility for vigilance, inspection, and enforcement in protected areas. Wardens must be provided with adequate training and equipment to deal with violators and operate with the military or other organizations in certain situations as required.
- In Mexico, there are conflicts among policies and actions from different agencies and/or levels of authority. Thus, there is need to promote requirements for overarching strategic assessments of federal laws and related policies, projects, and programs to minimize conflicts among objectives.
- The intervention of the military and other law enforcement groups brings with it environmental impacts that may be very detrimental for the integrity of ecosystems. The damage to vegetation, soil, and wildlife that result from operations to dismantle structures used for illegal activities could be minimized. Further work is needed to negotiate with the military the design and adoption of guidelines to reduce the impacts of operations on the environment and wildlife.

- The extraction of metallic and non-metallic materials affects both parks. Of more concern, however, are the impacts of mining at Ajos. The effects of open mining on the air, soil, and water are not fully known. Nevertheless, informants reported impacts not only the health of ecosystems but also the health of human populations in the area of influence of the park. Because of the combination of mining with other activities such as agriculture, it would be beneficial to conduct an assessment of cumulative effects in the area to adopt mitigation measures, where needed.
- Park staff indicated that a considerable part of their time is devoted to administrative functions and to meeting reporting requirements from national authorities and international funding organizations. Regulatory and reporting burdens reduce the time park staff could put into implementing conservation and management actions on the ground. This burden could be minimized if CONANP and park staff negotiate reporting requirements with national and international agencies and sponsors.
- Staff from Ajos and Pinacate Parks commented on the lack of support for the parks from local and regional communities. This seemed to be caused in part by the lack of awareness among the population about the objectives of the protected areas, the ecological services they provide at various geographical scales, and how the existence of the parks is related to their quality of life. It could be useful to review the content of education and outreach programs to emphasize those points. Delivering such programs to other public servants could help to increase that awareness and, perhaps, contribute to making inter-government coordination more effective.

These recommendations address the main factors influencing the ability of the two parks to achieve their conservation and management goals.

Implementing all the recommendations may be difficult in the short-term because of the current scarcity of human and material resources. The parks and CONANP staff could work together to prioritize and decide which recommendations should be implemented first. Based on our findings, the following actions are suggested as the most relevant (from most to least relevant) to gain public support for protected areas and to improve the effectiveness of park management and conservation projects:

1. Implement programs to educate communities and public servants about the ecosystem services both parks provide from a local to an international level. These should have an emphasis on how those services support the quality of life of human populations.
2. Consider alternatives to improve the effectiveness of law enforcement. Creating a law enforcement service exclusive for protected areas (similar to park wardens) is a preferable option since it would ensure a permanent presence of trained personnel in protected areas. Providing training to all or selected staff on how to coordinate with other law enforcement authorities, such as the military or the federal police, should be a priority because the variety of law infractions in both parks goes from relatively minor, such as drinking or vandalizing signage, to highly dangerous, such as dealing with armed drug dealers. Temporarily, one staff person in each park could be trained in vigilance and law enforcement. He or she should be empowered with authority to do intelligence and information-gathering, patrolling, enforcement, and referring perpetrators to PROFEPA for prosecution.
3. Promote the adoption of performance/accountability mechanisms for the agencies participating on the Trilateral Committee for Wildlife and Ecosystem Conservation and Management. This may include the

evaluation of the working tables' conservation outcomes, for instance, the recovery of a population of the species of common concern or an analysis of the factors that impede successful collaboration to improve the status of species and ecosystems on the ground. This would help focus resources where they may have a more positive influence and would show the commitment of each country to collaborate and improve the quality of the environment in North America.

The prompt implementation of these three suggestions, even if done one by one, would be a step forward for park management effectiveness. This would also signal that the Mexican government takes conservation seriously and would assist in attracting international resources to support the needed changes. Both Ajos and Pinacate play a key role in maintaining national biodiversity, but, most important, they are crucial for preserving ecosystem services and species for the entire North American region. Their proximity to the U.S.A./Mexico border has made them the focus of illegal activities that threaten their integrity, but their location is also a great advantage for the development and enhancement of formal and informal mechanisms for international collaboration.

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