

The citation for the book in which this chapter appears is: López-Hoffman, L., E.D. McGovern, R.G. Varady and K.W. Flessa, eds. In press 2009. Conservation of Shared Environments: Learning from the United States and Mexico. Tucson: University of Arizona Press.
http://www.uapress.arizona.edu/util/show_search_result.php?file=%2F%2FBOOKS%2Fbid2140.htm&terms=shared+environments&case=Insensitive

Mexican wolf recovery: Insights from transboundary stakeholders

Jose Bernal Stoopen, Jane M. Packard, Richard Reading

In a Nutshell

- To prevent extinction of endangered species in transboundary ecosystems, stakeholders in the United States and Mexico must coordinate their work.
- For many endangered species of the border region, issues such as insufficient suitable habitat and low genetic diversity can best be solved by cross-border collaboration among stakeholders.
- Regional recovery efforts should be coordinated by binational working groups for each transboundary ecosystem that provides habitat for several species of concern.
- The authors studied participants from both countries in recovery efforts for wolves and other species to document their collaboration priorities and practices.
- Priorities for achieving effective collaboration are: sufficient fund appropriations, multi-level government agency coordination, equitable U.S.-Mexico participation, personnel continuity, cultural exchange, and the establishment of binational working groups.

Introduction

Over a dozen species are at risk of decline or extinction in the ecosystems that cross the U.S.-Mexico border. Recovery programs aimed at reversing extinction have engaged diverse stakeholders in both countries.

Transboundary conservation must address the problem of coordinating relatively flexible local responses within the context of relatively inflexible regional, national or international politics. In working across the international border to protect species at risk, decision-makers need information about the actions most likely to benefit stakeholders, which include governmental agencies, landowners, captive breeding centers, scientists, and non-governmental conservation organizations (NGOs) engaged in species recovery efforts.¹

This chapter presents the results of a needs assessment of conservation practitioners working on several species at risk in transboundary ecosystems (listed in Table 1), including an in-depth case study of recovery efforts for the Mexican wolf (*Canis lupus baileyi*).² We first provide background information on the Mexican wolf. Next, we briefly describe our study methods and summarize the results. We describe the most pressing stakeholder concerns about the conservation of transboundary species and identify priorities for improving cross-border cooperation. We conclude with recommendations to establish binational working groups to coordinate endangered species recovery within each transboundary ecosystem.

Table 1. Distribution of selected species of concern in transboundary ecosystems under the jurisdiction of border states, coded as direct concern for existing population (++) , indirect concern for habitat (+) , and extirpated population (-) . Includes species listed at least at the level of "threatened" status by the IUCN Red List and/or either country.

Species at risk	Mexican border states						U.S. border states			
	BCN	SON	CHIH	COAH	NL	TAMPS	CA	AZ	NM	TX
Both Eastern and Western Ecosystems										
Mexican wolf (<i>Canis lupus baileyi</i>)		=	-	-				++	++	-
Jaguar (<i>Panthera onca</i>)		++	++		+	+		-	-	-
Northern aplomado falcon (<i>Falco femoralis septentrionalis</i>)			+			+		++	++	++

Primarily Eastern Ecosystems										
Jaguarundi (<i>Herpailurus yaguarondi</i>)							+			++
Kemp's ridley sea turtle (<i>Lepidochelys kempii</i>)							++			++
Maroon-fronted parrot (<i>Rhynchopsitta terrisi</i>)							++			+
Mexican long-nosed bat (<i>Leptonycteris nivalis</i>)				++	++	++		+	++	++
Mexican prairie dog (<i>Cynomis mexicanus</i>)				++	++					
Ocelot (<i>Leopardus pardalis</i>)							+			++
Primarily Western Ecosystems										
Black footed ferret (<i>Mustela nigripes</i>)			++						++	
Black-tailed prairie dog (<i>Cynomys ludovicianus</i>)			++					+	+	+
Imperial woodpecker (<i>Campephilus imperialis</i>)		-	-					-	-	
Mexican grizzly bear (<i>Ursus arctos nelsoni</i>)		-	-					-	-	
Mexican spotted owl (<i>Strix occidentalis lucida</i>)		+	+					++	++	
Pronghorn (<i>Antilocapra americana peninsula; A.a. sonoriensis; A. a. mexicana</i>)	++	++	+					+	+	+
Thick-billed parrot (<i>Rhynchopsitta pachyrhyncha</i>)		++	++					++	++	
Vaquita (<i>Phocoena sinus</i>)	++	++						+	+	

Background

The Mexican wolf is a charismatic and wide-ranging subspecies of the gray wolf (Figure 1). Its former range crosses the international border in the arid high elevation mountains and desert ecosystems. Over the past century, agricultural expansion policies have led to local extermination of predators such as wolves, due to conflicts with humans and livestock. Between 1910 and 1925, U.S. federal trappers reported killing over 900 wolves in Arizona and New Mexico.³ All but eliminated by 1970,^{3,4,5} the last wolves trapped in Mexico between 1977 and 1980 were the founders of a captive breeding population. Mexican wolves have become a symbol for stakeholders who believe that international collaboration can overcome the mismatch between the broad transboundary ranges of over a dozen endangered species and limited jurisdictions of state and federal government agencies.⁵

<Figure 1 here>

Figure 1. Mexican wolf in the Chapultepec Zoo in Mexico City, awaiting reintroduction into the wild. Photographed by Antonio Pastrana.

Approaches to recovery of the Mexican wolf

Because wolves are considered a keystone species, a "systems approach" connecting a broad network of sites is more likely to be successful than a "band-aid approach" to conservation of individuals in small, disconnected protected areas.^{6,7} No single protected area in the border region today is sufficiently large to support a viable breeding population of wolves.

A widely accepted metric for successful recovery of Mexican wolves is three connected core areas with at least 100 wolves each.⁸ To find enough prey, the typical wolf family group (2 parents, 1 subadult and 2 pups) is likely to range over 400-520 km² (248-323 mi²) per year.⁸ In a study in the Blue Range Wolf Recovery Area (17,775 km², 11,045 mi²), consisting of national forestlands in Arizona and New Mexico, dispersing Mexican wolves travelled 70-90 km (43-56 mi) before settling into a new area.⁸ In a study further north, typical dispersal distances for gray wolves were 750-1,500 km (466-932 mi).⁸

In 2006, the known population of Mexican wolves consisted of 50-60 individuals in 9 packs within the reintroduced Blue Range population and about 300 individuals in 48 captive facilities in Mexico and the U.S.^{9,10} Although some field biologists believe Mexican wolves may be hidden in remote mountains in Mexico, there is not sufficient evidence to suggest a viable wild breeding population in Mexico.⁹ Plans for additional reintroduction sites in Mexico and the U.S. are under discussion, although opposition by the livestock industry fuels controversy and delays the decision-making process.^{5,11,12}

U.S. and Mexican roles in recovery

The Mexican wolf was officially listed as endangered in the U.S. in 1976 and in Mexico in 1994. To start the captive breeding program under jurisdiction of the U.S. Fish and Wildlife Service, 5 wolves were captured in Mexico by Roy McBride.^{9,10} Compared to Mexico, the U.S. legal mandate and public pressure to conserve wolves is strong, mobilizing more resources for wolf recovery. However, the majority of potential habitat is in Mexico. In each country, federal dollars were expended on both the extinction (via wolf eradication and agricultural expansion policies) and the recovery of Mexican wolf populations. These seemingly contradictory policies are still debated among agencies at both state and federal levels.

Small, captive populations with high levels of inbreeding may suffer from low reproductive rates, abnormal sperm, high juvenile mortality, and genetic disease.^{10,13} A U.S. federal decision in 1987 that the captive breeding population of Mexican wolves was doomed to genetic failure was reversed in 1990 by a lawsuit that triggered a series of new actions by the U.S. Mexican Wolf Recovery Team.^{14,15} Prior to recent genetic studies, only the wild-caught wolves were recognized as a "pure" bloodline. These were identified as the "McBride" lineage.^{8,9} Descended from only 3 individuals, the McBride lineage is small in body size and litter size has been smaller than expected. Anomalies in both traits raise concern about the genetic health of small captive populations, although the genetic influence is hard to distinguish from environmental influences.

Thanks to modern technology and binational collaboration, genetic studies provided enough new scientific evidence to integrate two other bloodlines into the recovery program.¹⁰ Genetic diversity was enhanced by four additional founders from the "San Juan" and "Ghost Ranch" bloodlines, respectively maintained in Mexico and the U.S. Although inbreeding was high

while the San Juan and Ghost Ranch lineages were isolated, the network of facilities managing the McBride lineage used computer-based management techniques to minimize inbreeding. Descendants of these three lineages now interbreed in the reintroduced population in the Blue Range.⁸ The subsequent increase in litter size has been dubbed a "genetic rescue."⁹

The human dimensions of Mexican wolf recovery

When we started our research on stakeholders in 1995, much more was known about the biological than the human dimensions of Mexican wolf recovery.² An informal technical advisory group in Mexico facilitated communication within the network of captive breeding facilities and with the formal U.S. Recovery Team. The captive breeding effort was managed in Mexico according to the policies established by the Species Survival Plan of the Association of Zoos and Aquariums. Representatives of cooperating institutions met annually to make decisions about which wolves to breed and how to transfer them among institutions (Figure 2). For instance, when in the mid-1980s wolves from the McBride lineage filled all available space in U.S. facilities, three breeding pairs were transferred to Mexican facilities. Mexican wolf recovery efforts have been characterized by the strong motivation of a handful of individuals, a dedicated volunteer effort, and private resources donated to augment limited funding from the two federal governments.

<Figure 2 here>

Figure 2. Exchange visits between counterparts at Mexican and U.S. captive breeding facilities is an effective means of building trust, transferring technical expertise and facilitating cooperation among key actors.

Photographed by Jane M. Packard.

Study

Design and methods

In problems shared by multiple stakeholders, no single agency may have the authority to make decisions that would bind other participating organizations. In this study², we examined the following premise: To the extent that multiple conservation stakeholders are willing to discuss their perspectives on the costs and benefits of species recovery options, collaboration will be more likely. As a result of collaboration, innovative solutions will emerge for mutually beneficial plans of action that integrate local and national interests.

We could find no previously published studies of collaboration on endangered species crossing international borders, so our approach focused on understanding the system through needs assessment and a conceptual model.² Our needs assessment included three phases. The first consisted of in-depth semi-structured interviews with 44 Mexican wolf stakeholders. In the second, we used a hierarchical thematic analysis¹⁶ of the interviews to identify five major clusters of needs and concerns. Third, we surveyed 250 stakeholders working on multiple endangered species in the border area, including Mexican wolves and others (see Table 1), asking participants to rank the relative importance of the issues within each cluster. Mexican wolf recovery participants were included in the broader survey of other species recovery programs. We integrated results from the in-depth interviews and broader surveys to analyze how social factors influenced stakeholders' priorities about recovery decisions and binational collaboration.^{2,17}

Results

The interviewees from Mexican wolf recovery programs in the U.S. and Mexico spoke about needs that we categorized within 5 issue clusters:

resources, coordinated binational projects, organizations, culture, and people (interpersonal skills). These issue clusters were perceived as inter-related. For example, without a sound base of inter-cultural understanding, key actors were unlikely to successfully implement binational projects. Likewise, the resources required to support binational collaboration were unlikely to be mobilized without clearly defined roles for organizations on both sides of the border.

The highest priority needs from all clusters were: increased funding, managed with accountability; coordination of federal, state and local efforts; equitable participation by diverse stakeholders from both nations in project design and implementation; continuity of personnel; and exchange visits to facilitate understanding of diverse cultural perspectives. For 70% of the 26 need statements, respondents' rankings did not vary significantly by national origin of the participant or their participation in a particular species recovery program (except as noted in Table 2). Below, we examine each of the issue clusters developed from the wolf program interviews and the multi-species ranking of needs.

Table 2. Results of needs-assessment asking, "within each category, how would you rank the priority of needs over the next 3 years?"

<u>Issue cluster</u>	<u>Need</u>	<u>Priority Index^a</u>
Resources	Funding increase	81
	Funding management	71
	Information exchange	68
	New information ^b	66
	Skills training ^b	65
	Technology transfer	54

Coordinated projects	Project design	86
	Project management	73
	Project review	54
	Balance of captive/field effort ^c	49
	National autonomy	41
Organizations	Coordination: fed./state/local	75
	Institutional continuity	72
	Balance of government and non-governmental organizations	53
	Formal procedures	46
	Decentralization of decision-making ^b	45
Culture	Exchange visits	79
	Trust/reciprocity	71
	Bilingual skills	53
	Intercultural skills ^e	49
People (interpersonal skills)	Communication skills	84
	Continuity of participants	73
	Understanding diverse perspectives ^c	73
	Leadership skills	64
	Personal interaction skills ^d	60
	Negotiation skills ^e	52
<p>^a The Priority Index was based on weighted first-through-last place rankings within each cluster, standardized within each cluster on a scale of 1 to 100.²</p> <p>^b Mexican wolf recovery participants ranked item significantly lower priority than did participants of other programs (t-test, $P < 0.05$).</p> <p>^c Mexican wolf recovery participants ranked item significantly higher priority</p>		

than did participants of other programs (t-test, $P < 0.05$).

^d Mexican respondents ranked item significantly higher priority than did U.S. respondents (t-test, $P < 0.05$).

^e Mexican respondents ranked item significantly lower priority than did U.S. respondents (t-test, $P < 0.05$).

Resources

Respondents from all species programs described funding as the most important element to overcoming barriers to collaboration. A lack of financial resources was repeatedly described in interviews with wolf recovery participants as a barrier to basic communication among key actors. Where the will has existed to communicate across institutional and national boundaries; unequal distribution of resources has too often blocked the way to communicate.

From both sides of the international border, wolf program interviewees perceived a problem with inequitable distribution of economic resources between programs in the two countries, in favor of the U.S. One said, "If the level is not balanced . . . this situation will never allow an authentic effort. . . . [T]he day both countries can contribute equally, conservation will be working much better."

Other wolf program interviewees spoke about the practical implications of unmet funding needs: "I think part of the main problem . . . was money and being able to get the individuals funded." In particular, smaller institutions were less likely to have funds for international communication. A participant from one such institution said, "I do not have enough resources to send faxes or to send letters. . . I have to use a public telephone and stand in line so that I can use it." Interviewees also explained that

although smaller institutions were more flexible in decision making and problem solving, their "hands were tied" because they did not possess the resources needed to gain knowledge and implement decisions that might benefit the wider network of recovery participants.

Quantitatively, multi-species survey respondents identified "funding increase" as the first-priority resource-related need (Table 2). "Technology transfer" was ranked as the lowest priority. More than 41% of respondents chose "funding management" as the first- or second-priority. "Skills training" was ranked higher by Mexicans than by Americans. Participants in the Mexican wolf program ranked the need for "new information" significantly lower than did participants in other recovery efforts.

Coordinated Projects

Overall, respondents in both parts of the study indicated a need for clear definition of goals, objectives, tasks, and responsibilities of participating organizations from both countries. Respondents identified mobilizing resources and administrative commitment as variables that lead to effective action.

Some wolf recovery program interviewees identified the development of a truly binational plan to coordinate recovery efforts as key to binational collaboration. Interviewees from Mexico tended to use the term "binational program," while those from the U.S. used the term "recovery plan." Both terms refer to an official written document that participants would prepare and that the governments of both countries would approve.

Interviewees provided insights on why a project design balancing participation from both sides of the border was perceived as high priority for recovery efforts. Some described a shortage of transboundary coordination, and reasons for it: "Simply because of the magnitude of the

effort that we're trying to accomplish here in the U.S., [we] haven't had very much time to devote to the binational aspect of the effort." Thinking ahead, "What it is missing is a project that really identifies what the United States and Mexico need to do, who are the actors in Mexico and who are the actors in the United States, what is their responsibility and what is our responsibility." Additional benefits of a coordinated binational approach to project design and management include: better coordination of people from many disciplines, clearer assignment of responsibilities, the use of documented priorities to guide budget processes within federal institutions, and the ability to leverage decisions within and between agencies.

Some interviewees participating in the Mexican wolf program supported balancing input from stakeholders working on the captive breeding and field components, i.e., conservation in the wild. Such interviewees perceived the U.S. emphasis on ex-situ captive-breeding as different from the Mexican emphasis on in-situ management in the wild. Ironically, U.S. public support for Noah's-Ark-style captive breeding has provided leverage for key actors to continue Mexican wolf recovery efforts when support for expensive field studies dwindled. Priorities for field studies of wolves in Mexico were swamped by the initiatives spearheaded by private captive-breeding organizations within the structure of the Species Survival Plan.

A trade-off between captive and field efforts was apparently not as salient in recovery efforts for other transboundary endangered species, some of which are easier to maintain in captivity or less charismatic than wolves. In the needs survey, we investigated whether perceived needs related more to project design or to project management and review (Table 2). Eighty-three % of survey respondents ranked "project design" as the first/second priority. The vast majority of respondents (74%) agreed that "project management" was

the second/third priority. "National autonomy" was ranked low (fourth/fifth) priority by 72 % of respondents, and we found no significant effect of nationality on this or other needs ranked within the project issue-cluster.

Organizations

Survey respondents, as well as Mexican wolf program interviewees, agreed that better continuity and coordination among local, state, and federal agencies was a high-priority need to facilitate transboundary endangered species recovery (Table 2). One interviewee illustrated this, saying: "I dealt with 7 or 8 different directors in 6 or 7 years. There was no continuity." One interviewee from an NGO proposed that stable non-governmental institutions, such as zoos, universities and conservation organizations, could compensate for the lack of continuity within certain government organizations: "I first began stimulating [communication] by inviting individuals from Mexican wolf facilities ... to come to ... discuss the issues and to be involved in how we manage the Mexican wolf ... Through that process, we developed [and] kept communication going between both countries." In this instance, NGOs facilitated informal communication when a higher-level decision to halt the captive breeding program of Mexican wolves blocked formal channels. However, participants from other endangered species programs did not echo this perception.

We found no significant effect of nationality on priority rankings within the organizations cluster (Table 2). Most survey respondents (60%) ranked "coordination of federal/state/local" organizations as their first or second priority. Similarly, 62% of respondents ranked "institutional continuity" first or second. "Formal procedures" and a "balance of governmental and non-governmental organizations" received lower priority rankings. Overall, 61% of respondents rated the "decentralization of

decision-making" as a relatively low priority (4th or 5th). Participants in the Mexican wolf program ranked "decentralization" significantly lower than did participants in recovery efforts for other species.

Culture

In the context of this study, we use the term "culture" to refer to the tacit understandings that result from shared experiences. Understanding is tacit when members of one group understand each other without explicitly talking about an issue, whereas outsiders express the need for explanation. When we talk about cultural differences in this study, we refer to gaps in communication between captive and field researchers as well as between people who reside on different sides of a border.

Interviewees from the border region said that they found it much easier to coordinate efforts at the local level because their families had crossed the border for generations. They believed they understood the culture, language, and methods of reciprocal exchange better than agents of state and federal governments who were from distant locations: "[Collaborating organizations] need people along the border who understand the culture and preferably the language, because it's very difficult if you need an interpreter all the time."

Interviewees explained the need for exchange visits to improve trust and reciprocity in a historical context that has at times included paternalistic behavior by the United States toward Mexico. Further, they said, visits must not be superficial exchanges - visiting border towns was not a meaningful inter-cultural experience. In contrast, visiting workplaces in the heartland of each nation for the purpose of understanding the reasons for differing perspectives, developing personal rapport, and exploring meaningful mutual exchange were believed to be more beneficial. Examples of

meaningful exchange included informal gatherings as well as workshops and scientific meetings.

A majority of survey respondents (78%) ranked "exchange visits" as the first or second highest priority for addressing cultural issues, with no significant difference by nation of origin or recovery program (Table 2). These results were consistent with the high priority respondents gave in other clusters to communication skills, understanding diverse perspectives, coordinating efforts across agency levels, and to designing truly binational programs. The second highest ranked cultural need was "trust and reciprocity," which 65% of respondents agreed was the first or second priority. Respondents (74%) also agreed that the need for improving intercultural communication skills should receive the lowest- or second-lowest priority rank. Overall, U.S. participants tended to rank this need higher than Mexicans.

People (interpersonal skills)

Interviewees provided insights into what they meant by the need for personal communication skills, as distinct from bilingual skills. They suggested that language barriers could be overcome if both parties were highly committed to recovery efforts. One interviewee from Mexico asserted: "When there is a common interest, even when none of the parties can speak a word of the other language, the objective is the same." Conversely, even good language skills were insufficient if one key actor neglected to make the extra effort to understand diverse perspectives.

Interviewees described the need for personal rapport to facilitate interactions between institutions as a way of moving forward to meet project goals even when mistrust between government agencies inhibited collaboration. In this context, some interviewees explained that one well-trained cross-

cultural person in the international office of one agency was insufficient. The people we interviewed attributed the success of exchange visits in facilitating binational collaboration to the personal rapport and trust that develop as participants at local and regional levels worked together to accomplish tasks, such as exchanging breeding animals in the captive wolf program: "I think . . . there was not a question [of trust on a personal level], but there has always been the question of trust at the level of governments."

"Communication skills" emerged as a top priority within the people cluster (Table 2), independent of nationality or program. A majority of respondents (58%) ranked this need as their first or second priority, and only 5% ranked it as their lowest priority (5th or 6th). Based on our priority index (Table 2), survey participants equally ranked improving "understanding [of] different perspectives" and promoting "continuity among program participants." While 43% ranked continuity as high priority, 25-28% ranked these needs as lowest priority. Participants in the Mexican wolf program tended to rank "understanding" higher than participants in recovery efforts for other species. Overall, respondents gave "leadership skills" an intermediate-priority, with no significant effect of nation or program. Lowest priority was assigned to "personal interaction skills" and "negotiation skills."

Possible models

The Y2Y board, an initiative in the Rocky Mountains on the U.S. border with Canada, was established with substantial representation from boards appointed separately in Canada and the U.S.¹⁸ Although the huge scale of the Y2Y initiative made it vulnerable to critique and misrepresentation by detractors, the initiative, led by non-governmental organizations, may serve

as a working model for future initiatives on the U.S.-Mexican border, with some important modifications (such as addressing uncertainties from climate change, illegal narcotics traffic, and water allocation).

A more localized place-based approach, as undertaken by the International Sonoran Desert Alliance, would unlikely meet the habitat needs of wide-ranging species like Mexican wolves. For these reasons, we emphasize the need for linking local and regional initiatives, facilitating both flexibility and continuity in transboundary landscapes. Bernal-Stoopen previously recommended an informal approach for the U.S.-Mexican border, matching formal government planning with informal capacity-building using independent consultants to maintain the flexibility of small working groups while enhancing information flow among groups.²

Incorporating ideas developed by others,^{18,19,20} we recommend coordinating species-specific, binational working groups as subcommittees under the umbrella of larger, ecosystem working groups that coordinate planning for sets of species found within similar landscapes. Within each country, representatives of the federal government ideally would meet annually with representatives of different stakeholder groups to hear their perspectives and integrate their needs and recommendations into an adaptive approach to implementing plans. Utilizing the services of experienced consultants, non-governmental organizations should play a more active role in acknowledging, understanding, and integrating the perspectives of all stakeholders.

In our research, most participants in recovery programs for transboundary species agreed with respect to the highest-priority needs. To meet these needs, we recommend an approach that embeds multiple species within ecosystems, to create binational working groups for each of the 13

transboundary endangered species.² A working group for each ecosystem should address the cross-cutting issues associated with specific endangered species.

Each binational working group should be structured to minimize hierarchical structure, facilitate information exchange, embrace innovation, seek consensus, represent stakeholders from both countries and encourage better cross-cultural communication.^{20,21} We extend these recommendations to any landscape-level working groups that might form, considering lessons learned in other transboundary initiatives.^{22,23,24} Binational working groups should not only provide the best biological recommendations for species recovery, but also consider pertinent social, organizational, economic, political, and cultural issues.² Ideally, binational working groups should remain "task-oriented", maximizing trust and reciprocity established via exchange visits, thereby minimizing issues of power and authority that can derail decision-making.

Conclusions

Through qualitative and quantitative research among stakeholders in species recovery efforts along the international border between Mexico and the United States, we identified priorities for decision-makers as they weigh actions that would benefit practitioners working toward biodiversity conservation in the transboundary region. These included: increased funding, managed with accountability; continuity and coordination of federal, state, and local efforts; equitable binational participation in project design and implementation; exchange visits to facilitate trust and reciprocity; and improved communication skills and continuity of personnel to foster better understanding of the diverse perspectives of stakeholders.

We found high levels of agreement on top priorities that were consistent across the international border. These results offer insight that

will hopefully improve conservation success rates in important transboundary ecosystems and across landscapes.

Based on this needs assessment, we recommend establishing binational working groups for each transboundary ecosystem providing habitat for endangered species. This would optimize the use of scarce resources, while facilitating cross-fertilization of ideas and coordination of local, state, and federal efforts.

Overall, this work revealed the value of key actors who are motivated to fill in the gaps between the formal procedures of government agencies. Social dimensions must be considered in conjunction with biological issues in a coordinated, interdisciplinary approach to recovering endangered species in the ecosystems that cross international and state boundaries.

Acknowledgments

We thank all participants in this study. In addition, we acknowledge Wendy Brown, Ernesto Enkerlin, Fred Koontz, Laura López-Hoffman, Emily McGovern, Brian and Carina Miller, David Parsons, Peter Siminski, Edward Spevak and Priscilla Weeks; Conacyt/Fullbright Fellowship, SEMARNAT, Wildlife Conservation Society, Lincoln Park Zoo Neotropical Fund, Earth Promise Fund of Fossil Rim Wildlife Center, Denver Zoological Foundation, Department of Wildlife and Fisheries Sciences, and National Science Foundation Grant No. 0551832. These institutions are not to be held accountable for the content of this chapter.

Endnotes

¹ Although there are many nodes of consensus between different stakeholders, fundamental differences in perspective also exist. For instance, certain key actors have pivotal experience in multiple endangered species programs.

Others work within organizations that are more isolated and more narrowly focused on one species.

² The full study, including methods and interpretation of results, was documented in more detail in Bernal Stoopen 2004. Bernal Stoopen, J. F. 2004. Binational collaboration in endangered species recovery efforts: a case study of the Mexican wolf. Ph.D. Dissertation. Texas A&M University, College Station, Texas.

³ Brown, D. 1983. The wolf in the southwest: the making of an endangered species. University of Arizona Press, Tucson, Arizona.

⁴ Burbank, J. C. 1990. Vanishing lobo: the Mexican wolf and the southwest. Johnson Publishing Company, Boulder, Colorado.

⁵ Holaday, B. 2003. Return of the Mexican gray wolf: back to the Blue. University of Arizona Press. Tucson, Arizona.

⁶ Ceballos, G., P. Rodriguez, and R. A. Medellin. 1998. Assessing conservation priorities in megadiverse Mexico: mammalian diversity, endemism and endangerment. *Ecological Applications* 8: 8-17.

⁷ Carroll, C., Phillips, M. K., Lopez-Gonzalez, C. A. and Schumaker, N. H. 2006. Defining recovery goals and strategies for endangered species: The wolf as a case study. *Bioscience* 56: 25-37.

⁸ Interagency Field Team (IFT). 2005. Mexican Wolf Blue Range Reintroduction Project 5-Year Review: Technical Component. Arizona Game and Fish Department, New Mexico Department of Game and Fish, U.S.D.A. - APHIS, Wildlife Services, U.S.D.A. Forest Service, U.S. Fish and Wildlife Service, White Mountain Apache Tribe. Albuquerque, N.M. 74 pp.

⁹ Fredrickson, R. J., Siminski, P., Woolf, M., and P.W. Hedrick. 2007. Genetic rescue and inbreeding depression in Mexican wolves. *Proceedings of the Royal Society B-Biological Sciences* 274: 2365-2371.

¹⁰ Hedrick, P. W. and R.J. Fredrickson. 2008. Captive breeding and the reintroduction of Mexican and red wolves. *Molecular Ecology* 17: 344-350.

¹¹ Agricultural producers raised concerns that livestock operations in Texas, Sonora, California, and Colorado are within potential colonization distance of the Blue Range wolves. See Povilitis et al. (2006) and Fitzgerald (2006 note12). Povilitis, A., D. R. Parsons, M. J. Robinson, and C. D. Becker. 2006. The bureaucratically imperiled Mexican wolf. *Conservation Biology* 20:942-945.

¹² Fitzgerald, E. A. 2006. Lobo returns from limbo. *New Mexico Cattlegrowers Ass'n. v.s. U.S.A. Fish and Wildlife Service. Natural Resources Journal* 46:9-64.

¹³ Asa, C., Miller, P., Agnew, M., Rebolledo, J. A. R., Lindsey, S. L., Callahan, M. and K. Bauman. 2007. Relationship of inbreeding with sperm quality and reproductive success in Mexican gray wolves. *Animal Conservation*. 10:326-331.

¹⁴ The U.S. Fish and Wildlife Service appointed a Mexican Wolf Recovery Team in 1979. U.S. Fish and Wildlife Service (USFWS). 1982. Mexican wolf recovery plan. USFWS, Albuquerque, New Mexico.

¹⁵ In 1991, the USFWS established a new recovery team and hired a full-time recovery coordinator to manage the captive population for reintroduction, identify potential reintroduction sites in the United States, and search for evidence of wild wolves in northern Mexico. Parsons, D. R. and J. E. Nicholopolous. 1995. An update of the status of the Mexican wolf recovery program. Pp 141-6 in L. N. Carbyn, S. H. Fritts, D. R. Seip, editors. *Ecology and conservation of wolves in a changing world*. University of Alberta Press, Edmonton, Alberta.

¹⁶ Peterson, T. R., K. Witte, E. Enkerlin-Hoeflich, L. Espericueta, J. T. Lora, N. J. Florey, N.T. Loughran, and R. Stuart. 1994. Using informant directed interviews to discover risk orientation: how formative evaluations based in interpretive analysis can improve persuasive safety campaigns. *Journal of Applied Communication Research* **22**:199-215.

¹⁷In the results of the survey, potentially confounding effects of demographic variables were documented for national origin, work experience, education and gender. Three variables were significantly affected by national origin: current position, age, and degree of bilingualism. Significance was based on the chi-square test, $p < 0.05$, as documented in Bernal Stoopen (2004, note 2).

¹⁸ Chester, C. C. 2006. *Conservation across borders: biodiversity in an interdependent world*. Island Press, Washington, D.C.

¹⁹ Clark, S. G. 2008. *Ensuring Greater Yellowstone's Future: choices for leaders and citizens*. Yale University Press, New Haven, CT.

²⁰ Bernal Stoopen (2004, note 2). Based in part on Chester (2006, note 18), and in line with the "generative" organizational model described by Gordon (1983) and Westrum (1994). Gordon, J. R. 1983. *A diagnostic approach to organizational behavior*. Allyn and Baco, Boston, Massachusetts. Westrum, R. 1994. *An organizational perspective. Designing recovery teams from the inside out*. Pages 327-350 in T. W. Clark, R. P. Reading, and A. L. Clarke, editors. *Endangered species recovery: finding the lessons, improving the process*. Island Press, Washington, D.C.

²¹ Brislin and Yoshida (1994) elaborate on cross-cultural issues. Brislin, R. W., and T. Yoshida, Editors. 1994. *Improving intercultural interactions: modules for cross-cultural training programs*. Sage Publications, Beverly Hills, California.

²² Chester (2006, note 18) has elaborated on these ideas with respect to conservation across boundaries between countries and states.

²³ Clark (2008, note 19) develops the themes in more detail regarding boundaries between lands under jurisdiction of separate state and federal agencies.

²⁴ Additional examples are summarized in Reading & Miller 2000. Reading, R.P. and B. Miller (eds) 2000. *Endangered Animals: Conflicting Issues*. Denver: Greenwood Press.

Author Biographical Sketches - May 5, 2009

- [Patty Balvanera studies links between biodiversity, ecosystem function, and associated services to society. Balvanera was awarded the Man and the Biosphere-UNESCO award for Young Scientists and is an Aldo Leopold Leadership fellow.](#)
- Jose F. Bernal Stopen is General Director of Wildlife and Zoos in Mexico City. He holds degrees from Texas A&M University and Universidad Autónoma Metropolitana-Xohimilco.
- Mark Briggs is with the World Wildlife Fund's Chihuahuan Desert Program, currently focusing on implementation of binational river rehabilitation along the Rio Grande.
- Luis Calderon is professor at CICESE, Ensenada, Baja California, interested in ecosystem-based management and global change. He has worked on fisheries ecology in the Upper Gulf of California since 1984.
- Gerardo Ceballos is an ecology and conservation biology professor at UNAM working on endangered species, nature reserves, and land planning.
- Charles C. Chester is author of [Conservation Across Borders: Biodiversity in an Interdependent World](#) (Island Press 2006) and teaches at Brandeis

University. He serves on the board of the Yellowstone to Yukon Conservation Initiative.

- Ana Córdova is research professor at El Colegio de la Frontera Norte in Ciudad Juárez. Formerly Director General of Landscape Ecological Land-Use Planning and Ecosystem Conservation at SEMARNAT's National Institute of Ecology, her prior experience includes consultancies with CEC and TNC.

- Melanie Culver is assistant professor of wildlife and fisheries conservation and management and part of the Arizona Cooperative Fish and Wildlife Research Unit, USGS, at the School of Natural Resources and Environment, UA. Her research involves conservation genetics for mammals, birds, fish, herps, and invertebrates.

- Ana Davidson is an NSF Research Fellow at the Instituto de Ecología, UNAM. Her research focuses on grassland ecology and biodiversity conservation.

- Carlos de la Parra is professor at El Colegio de la Frontera Norte (COLEF) in Tijuana, studying U.S.-Mexico relations, bilateral environmental management and sustainability. He has previously served as COLEF's Provost, as SEMARNAT's Regional Officer in Baja California, and as the agency's Representative in the Mexican Embassy in Washington.

- Karl W. Flessa is professor and head of the Department of Geosciences, UA. A paleontologist by training, he has worked on the conservation and restoration issues in the Colorado River Delta since 1992.

- Ed L. Fredrickson is a scientist working with the USDA-ARS Jornada Experimental Range.

- Osiris Gaona is research specialist at the Institute of Ecology, UNAM, where she focuses on conservation of bats in Mexico and North America, including work with the CEC Trilateral Committee.
- Randy Gimblett is professor in the School of Natural Resources and Environment, UA. His research includes spatial dynamic ecosystem modeling, environmental perception, and human movement in visitor landscapes.
- Louis A. Harveson is professor of wildlife management at Sul Ross State University and director of the Borderlands Research Institute for Natural Resource Management.
- Patricia Moody Harveson is assistant professor of conservation biology at Sul Ross State University. Her research includes carnivore ecology, desert ecosystems, and using modeling in the conservation of rare and threatened species.
- Jeff Herrick is a scientist with the USDA-ARS Jornada Experimental Range, focusing on the factors controlling resilience at multiple scales and development of assessment and monitoring systems.
- Rick Knight is professor of wildlife conservation at Colorado State University and co-editor of The Essential Aldo Leopold, and Aldo Leopold and the Ecological Conscience.
- Rurik List is a conservation biologist at the Institute of Ecology, UNAM, focusing on endangered species habitat conservation.
- Mark Lockwood is Natural Resource Coordinator for the state of Texas' Trans-Pecos region. He leads river rehabilitation efforts in Big Bend Ranch State Park.
- Laura López-Hoffman is assistant professor at the School of Natural Resources and Environment and Udall Center for Studies in Public Policy, UA.

Her research on the ecology and policy of managing transboundary systems emphasizes ecosystem services shared by the U.S. and Mexico.

- Donna L. Lybecker is assistant professor of political science at Idaho State University, focusing on natural resource conservation on the U.S.-Mexico border.
- Carlos Manterola is president of Grupo Anima Efferus and Conservation Director of the Jaguar Conservancy. Carlos has worked with the CEC Trilateral Committee on its shared species agenda and international protected areas.
- Lourdes Martínez is a Master of Sciences student at the Instituto de Ecología, UNAM.
- Emily D. McGovern is a researcher and editor at the Udall Center for Studies in Public Policy, UA, focusing on social and environmental aspects of the U.S.-Mexico border region and on water policy.
- Bonnie Reynolds McKinney is wildlife coordinator for the CEMEX-Proyecto El Carmen Wildlife Area in Coahuila, Mexico.
- Rodrigo A. Medellín has worked on the ecology and conservation of Mexican mammals for over 30 years. He is senior professor of ecology at UNAM's Institute of Ecology, Mexico City.
- Stephen P. Mumme is professor of political science at Colorado State University. He has consulted for the CEC on North American inland water management and is a long-time observer of environmental management along the U.S.-Mexico border.
- Jesús Pacheco is an ecologist, conservation biologist, and a Master of Sciences student at the Instituto de Ecología, UNAM.
- Jane M. Packard is associate professor and director of the Biodiversity Stewardship Lab, Texas A&M University. She integrates cultural and biological

perspectives on biodiversity conservation, emphasizing communication across disciplinary and physical boundaries.

- Jessica Piekielek is a doctoral candidate at the UA. Her research in environmental anthropology focuses on the U.S.-Mexico borderlands.
- Adrian Quijada Mascareñas is adjunct professor at the School of Natural Resources and Environment, UA. He is a herpetologist with conservation experience on Mexican private land and ejidos, particularly working with Indigenous communities.
- Richard P. Reading is founder and director of the Denver Zoological Foundation's Department of Conservation Biology, associate research professor at the University of Denver, and affiliated faculty at Colorado State University.
- Brian Segee is a staff attorney with Defenders of Wildlife in Washington, D.C., focusing on the protection of imperiled species and their habitat.
- Christopher Sharp is a doctoral candidate at the UA, focusing on recreation behavior in backcountry and wilderness settings, measures of user impacts, and GIS techniques for recreation management.
- Rodrigo Sierra Corona is a doctoral student at the Instituto de Ecología, UNAM.
- Carlos Sifuentes is director of Áreas de Protección de Flora y Fauna Maderas del Carmen y Cañón de Santa Elena, and leads river conservation efforts along the Mexico side of the Rio Bravo.
- Joe Sirotnak is lead botanist at Big Bend National Park, responsible for vegetation management, exotic plant management, ecological restoration, and threatened and endangered plant species conservation.

- Matt Skroch is a research assistant at the UA's School of Natural Resources and Environment studying conservation implications of climate change in the transboundary Madrean Archipelago.
- Rachel Starks is research analyst for the Native Nations Institute for Leadership, Management and Policy at the Udall Center for Studies in Public Policy, UA. She has research experience in tribal governance, border issues, tribal courts, and asset building.
- Robert Varady is deputy director of the UA's Udall Center for Studies in Public Policy, where he is research professor of environmental policy. Varady has written extensively on U.S.-Mexico environmental policy and on global water initiatives.
- Cora Varas is a doctoral candidate in the School of Natural Resources and Environment, UA, researching genetic techniques to understand the evolution and habitat connectivity of Southwestern black bear populations.
- Evan R. Ward is associate professor of history at the University of North Alabama and author of Border Oasis: Water and the Political Ecology of the Colorado River Delta, 1940-1975 (University of Arizona Press, 2003).
- Francisco Zamora-Arroyo is director of the Upper Gulf of California program at the Sonoran Institute and a researcher in the Department of Geosciences, UA. He has worked more than 10 years in the Colorado River delta building collaborations between water managers and local stakeholders.