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ASSESSMENT OF TROPICAL FOREST AND BIODIVERSITY CONSERVATION IN MEXICO

FAA SECTIONS 118-119 REPORT

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Prepared for the United States Agency for International Development, USAID Contract Number EEM-I-00-07-00004-00

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EXECUTIVE SUMMARY

This document was prepared to comply with the Foreign Assistance Act (FAA) of 1961, Sections 118 and 119. It provides a description of Mexico's biodiversity and tropical forests, as well as an analysis of the actions necessary to protect biodiversity and achieve sustainable management of tropical forests. The report also assesses how the United States Agency for International Development can most effectively support these efforts. The analysis is based on interviews with environmental experts and secondary data sources, including publications from governmental and non-governmental organizations.

Mexico's Biodiversity

Mexico is one of the most biodiverse countries in the world. Its territory covers only 1.4% of the planet but is home to about 10 to 12% of the world's known species, the fourth highest percentage in the world. Natural vegetation covers an area of over 140 million hectares (ha) in Mexico, which represents around 73% of the country's territory. Over the last decades, Mexico has experienced significant loss of vegetation cover as a result of ecosystem transformation and the degradation of existing ecosystems. These phenomena have affected most of Mexico's ecosystems, but the effects have been more severe in rainforests and mesophile forests, where primary vegetation covers only a fraction of its original area.

Mexico has a total forest surface of 64 million ha, which makes it the country with the 12th largest forest surface in the world. Unfortunately, Mexico's deforestation rate is also one of the highest among countries with significant forest cover. According to the National Forestry Commission of Mexico (CONAFOR), net deforestation averaged 348,000 ha/year during 1990-2000, and 260,000 ha/year during 2000-2005 (SEMARNAT, 2007). Other estimates are higher. Most estimates concur that deforestation remains alarmingly high, but has fallen recently, arguably due to changes in the legal and institutional framework.

Most freshwater ecosystems in Mexico are rivers, while the rest are distributed in aquifers, lakes and reservoirs. Mexico's coastal and marine wetlands support the country's fisheries industry, which is among the 20 largest in the world. Mangroves, which support rich biodiversity and provide valuable environmental services, once covered nearly 1.5 million ha At present, they are estimated at just over 650,000 ha In 2005, the estimated rate of mangrove deforestation was 1.1%, and SEMARNAT estimated that only 40-50% of the present area would be left by 2025 if current conditions persist.

Socio-Economic Aspects

Ejidos and communities own 80% of Mexico's forests. Only in Papua New Guinea do communities own a larger percentage of natural forests. An estimated 19 million ha of natural vegetation are located in areas with important populations of indigenous groups. These areas include significant portions of mesophile forests and humid rainforests. Conflicts over use of, and access to, natural resources have been associated with a tension between conservation and development goals. Communities and *ejidos* whose land is under protection status often resent restrictions on traditional economic activities (such as agriculture and livestock) and do not perceive opportunities to benefit from protecting biodiversity. Laws and regulations aiming to ensure that forests are protected and used sustainably also impose

constraints on owners of forested land. Given the high levels of marginalization in many forest areas, these constraints are often perceived as imposing a burden on groups that already face poverty and difficult conditions.

Government Efforts to Protect Biodiversity and Forests

During most of the twentieth century, governmental regulation of natural resource use focused on increasing agricultural, fisheries, and forest production. Environmental criteria were absent, and some governmental programs had devastating environmental effects. In 1994, the Ministry of Environment, Natural Resources and Fisheries (SEMARNAT) was established with the aim of promoting environmental protection and sustainable management of natural resources in an integrated manner. The Ministry – renamed SEMARNAT when fisheries were transferred the agricultural ministry -- is a purely normative entity, as it focuses mostly on regulating access to, and use of, renewable natural resources. Other sectoral entities, such as the National Commission of Natural Protected Areas (CONANP), carry out conservation activities.

SEMARNAT has aimed to coordinate its efforts with those of other sectoral agencies. The cross-sectoral programs (*Agendas de Transversalidad*) have helped to mainstream environmental criteria in government agency work. Still, a number of public programs continue to foster unsustainable use of natural resources. Mexico has developed a comprehensive legal framework for environmental and natural resource management under the General Law of Environmental Equilibrium and Protection (LGEEPA). With Congress becoming a truly autonomous power, environmental legislation has proliferated. New laws, regulations and official Mexican norms (currently numbering more than 100) partly reflect a growing sophistication in environmental management, but also represent challenges for environmental enforcement agencies. Government of Mexico (GoM) programs currently cover an area of over 40 million ha Natural protected areas and Management Units for Sustainable Use of Wildlife (UMAs) cover the larger share, although payment for environmental services and sustainable forest management has played an increasingly important role.

Threats to Mexico's Biodiversity and Forests

The principal direct threats to Mexico's biodiversity and forests are the many effects of climate change and land conversion, which has occurred mainly as a result of the expansion of cattle breeding, agriculture, commercial timber plantations, and urban growth. Other important direct threats include hydro-meteorological disasters, forest fires, Invasive species and diseases, over-harvesting, freshwater and aquifer depletion and contamination, and illegal logging. Socio-economic factors play a crucial role, particularly the effect of market forces on agricultural and livestock activities, poverty and the lack of economic alternatives for rural communities, low competitiveness of community forest enterprises, and organizational deficiencies of producer organizations, among others. A number of indirect threats related to poor governance also affect Mexico's biodiversity and forests. Prominent among these are perverse policies that indirectly encourage land use change, excessive regulations that inhibit the development of forestry and other natural resource-based activities, lack of security and perverse incentives regarding land ownership.

USAID Programs in Mexico and Recommendations for Further Action

USAID's environmental program in Mexico helps conserve the country's forests and biodiversity. However, the effect of some programs that aim to stimulate economic development could potentially increase pressures on the environment if not carefully planned. Most USAID activities support policy-making, capacity building, and knowledge sharing. The environmental effects of these types of activities are more difficult to predict and monitor than those of investment projects. The recommended approach is to mainstream sustainability considerations in all USAID activities. USAID can play a fundamental role in supporting Mexico's efforts to protect and manage biodiversity and forests. The following recommendations focus on areas in which governmental and NGO efforts are missing or need to be scaled up, and where USAID can add value given its previous experiences and available technical, financial and human resources.

1. Strengthen the capacity of government agencies for environmental management. USAID can support Mexico's efforts to address threats to biodiversity and forests by providing assistance in three main areas: strengthening the capacity of the environmental sector to implement existing policies and enforce environmental laws; streamlining regulations and adopting best practices for sustainable natural resource management, and facilitating coordination between the environmental sector and other sectors.
2. Support efforts to enhance environmental governance at federal and state levels. USAID has supported Mexico's past efforts to improve governance and is well-positioned to focus on the environment sector. The Environmental Transparency Initiative, co-funded by USAID, is an important step in that direction. USAID can build on these efforts by supporting robust assessments of the efficiency and effectiveness of governmental programs and policies. It can also work with state governments to help enhance the institutional capacities of state and local authorities that are willing to adopt environmental management responsibilities.
3. Help landowners to develop and sell environmentally-friendly goods and services. Most forests and important ecosystems in Mexico are property of *ejidos* and communities. A key challenge to forest and biodiversity conservation is to implement actions that will enable landowners to protect biodiversity by engaging in productive activities that improve their quality of life. USAID should focus on helping landowners to acquire the skills and knowledge to adopt environmentally-friendly practices. Also, landowners need substantial support to sell their products and services to markets that pay a premium price, including technical assistance to meet quality, volume, and time requirements.
4. Enhance the capacity of rural communities to sustainably use natural resources. The local organization (community) and the formation of strong, respected, responsible and transparent institutions have proven to be an essential factor in the preservation and sustainable use of natural resources. USAID can assist in strengthening local initiatives seeking to build institutional capacity at the local level, particularly those that aim to enhance accountability, democratic processes, local governance, and impartiality in decision-making.
5. Help expand the knowledge base for biodiversity and forest management. Mexico needs to enhance its information and analytical base for biodiversity and forest management. There are gaps in areas such as marine biodiversity and genetic diversity. Even the information base for forests, a relatively well-studied ecosystem, is plagued by inconsistencies that constrain decision-making and policy improvement. USAID has supported the National Commission for the Knowledge and Use of Biodiversity (CONABIO) and other agencies in the past to strengthen the biodiversity information base and is well positioned to continue doing so.

LIST OF ACRONYMS

CBD	Convention on Biological Diversity
CCMSS	Mexican Civil Council on Sustainable Forestry
CDM	Clean Development Mechanism
CEC	Commission for Environmental Cooperation
CITES	Convention on the International Trade of Endangered Species of Wild Fauna and Flora
CNA	National Water Commission
CONABIO	National Commission for the Knowledge and Use of Biodiversity
CONACYT	National Science and Technology Council
CONAFOR	National Forestry Commission of Mexico
CONANP	National Commission of Natural Protected Areas
EFC	*Empresa Forestales Comunitaria* (Community Forest Enterprises)
FAA	Foreign Assistance Act
FAO	Food and Agriculture Organization
FMCN	*Fondo Mexicano para la Conservación de la Naturaleza*
FSC	Forest Stewardship Council
GoM	Government of Mexico
IMTA	Mexican Institute for Water Technology
INE	National Institute of Ecology
INEGI	National Institute of Statistics and Geography
IWC	International Whaling Commission
LGEEPA	General Law of Environmental Equilibrium and Protection
MBC	Mesoamerican Biological Corridor
POP	Persistent Organic Pollutant
PROCEDE	Program for Certification of *Ejido* Rights and Title Granting
PROFEPA	Federal Attorney General for Environmental Protection
SAGARPA	Ministry of Agriculture, Cattle, Rural Development and Fisheries
SEDESOL	Ministry of Social Development
SEMARNAT	Ministry of Environment and Natural Resources
SLIMF	Small and Low Intensity Managed Forests
SNIB	National System of Information on Biodiversity
SRE	Ministry of Foreign Affairs
UMA	Management Unit for Sustainable Use of Wildlife
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development

INTRODUCTION

• Purpose

This document has been prepared as required by the Foreign Assistance Act (FAA) of 1961, Sections 118 and 119. According to these sections, each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of:

(1) The actions necessary in that country to achieve conservation of biodiversity and conservation and sustainable management of tropical forests, and

(2) The extent to which the actions proposed for support by the Agency meet the needs thus identified.

This document builds on the analysis conducted in 2003, but identifies changing conditions and new trends that are relevant for the conservation of biodiversity and tropical forests in Mexico.

• Methods

This analysis is primarily based on secondary data sources, including publications from governmental and non-governmental organizations. A team of consultants was sub-contracted by the *Fondo Mexicano para la Conservación de la Naturaleza* (FMCN) to carry out stakeholder consultations and interviews. The findings from those meetings have also been incorporated into the analysis.

The report follows the guidance provided by documents "Tropical Forestry and Biodiversity (FAA 118 and 119) Analyses: Lessons Learned and Best Practices from Recent USAID Experience", and "Best Practices for Biodiversity and Tropical Forest Assessments". Both of these documents are available at USAID's website: http://www.usaid.gov/our_work/environment/biodiversity/118_119_analyses.html

STATUS OF BIODIVERSITY

• Introduction

Mexico is one of the most biodiverse countries in the world. [1] Its territory covers only 1.4% of the planet but is home to about 10 to 12% of the world's known species, the fourth highest percentage in the world. Alongside with China, Peru, Colombia, and India, Mexico is one of the five countries in the world with the highest variety of ecosystems (SEMARNAT, 2007; CONABIO, 2006). Mexico's unique biodiversity provides environmental goods and services that are essential for life, are the basis for the livelihoods of rural populations, and offer opportunities for economic advancement and improved livelihood.

• Ecosystem Diversity

The vast diversity of ecosystems in Mexico is largely the result of a combination of complex topography (very rugged relief with large altitude variations), complex geological composition (variety of rock types) and latitudinal differences. Because of their complex biogeographic history and evolution, Mexico's ecosystems are different from similar ecosystems in other countries (Challenger, 1998). More than half of Mexico consists of arid and semi-arid regions, located in the north and center regions. A third of the country consists of humid and subhumid warm regions; while temperate regions occupy approximately 20% (subhumid) and one percent (humid) of the nation.

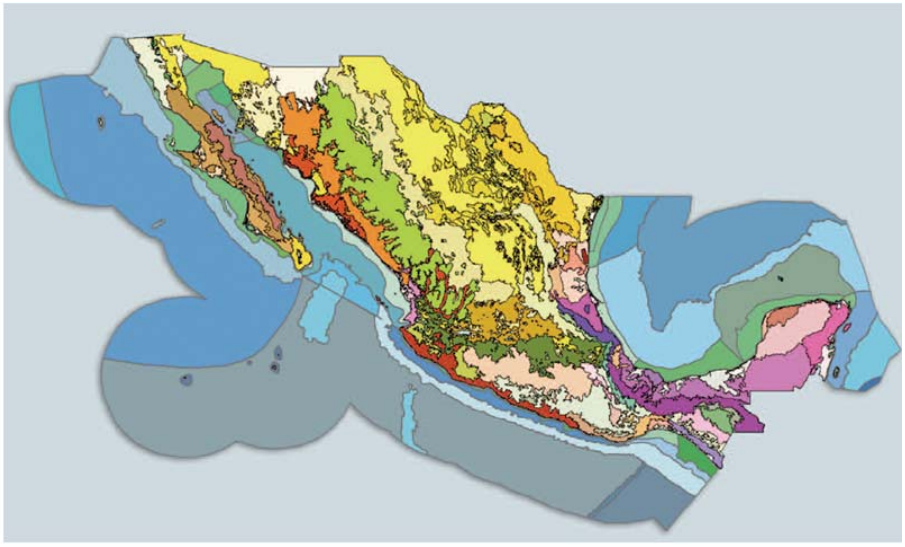
• Ecoregions[2]

Mexico's territory hosts a vast universe of eco-regions, each having unique environmental conditions, species, ecological processes, and evolutionary histories. The Commission for Environmental Cooperation (CEC) defined 56 marine ecoregions and CONABIO identified 75 terrestrial eco-regions (Map 1) (CONABIO, 2006). This diversity implies that government and other stakeholders must develop conservation strategies that can be tailored to the distinct characteristics of each eco-region.

[1] The Convention on Biological Diversity defines biodiversity as "*variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems*". Also important are the evolutionary and functional aspects of biodiversity, which include the different life forms, endemism and the diversity of domesticated species (Dirzo and Raven, 2003).

[2] Ecoregion is a geographic area of relatively large expanse, which is homogeneous in terms of its environmental conditions, species and ecological processes. This concept exceeds biogeographic regions, which refer only species distribution and its evolutionary history.

Map 1. Marine and Terrestrial Ecoregions in Mexico



Source: CONABIO (2006)

• Natural Vegetation and Land Use

Data from the National Institute of Statistics and Geography (INEGI) for 2002 indicate that natural vegetation covers an area of over 140 million ha in Mexico, which represents around 73% of the country's territory. Agricultural and pasture lands, water bodies, and urban areas comprise the remaining territory. SEMARNAT classifies existing vegetation in ten categories (Table 1), which group a total of 52 terrestrial ecosystems (SEMARNAT, 2006).

Table 1. Vegetation Coverage

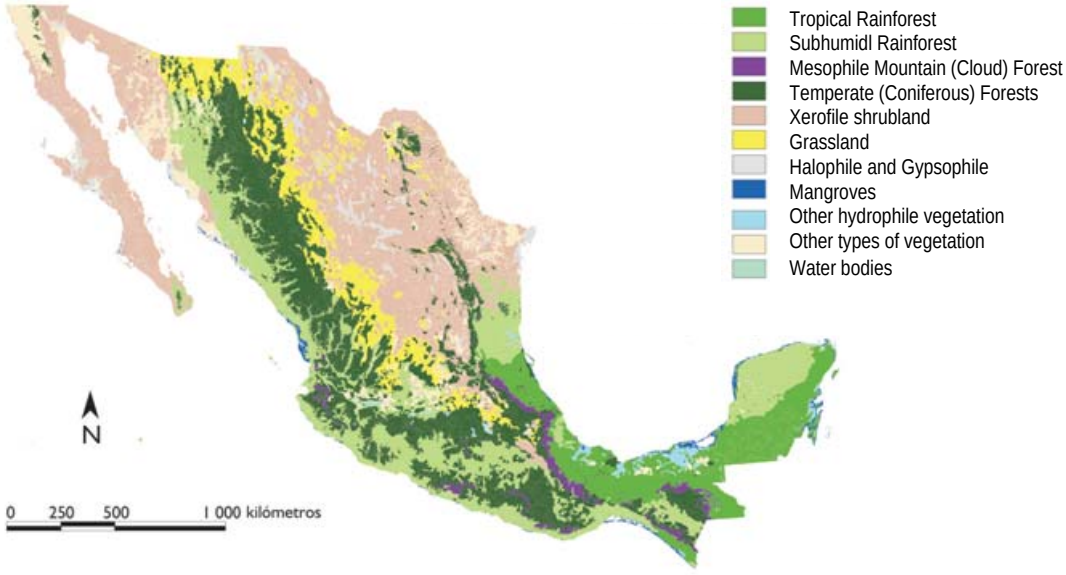
Type of Vegetation	Surface (Ha)	Percentage
Xerofile Shrubland	52,879,694	37.3%
Temperate Forest	32,330,511	22.8%
Subhumid Rainforest	23,470,314	16.6%
Natural grassland	10,315,933	7.3%
Tropical Rainforest	9,465,901	6.7%
Halophile and Gypsophile	4,638,657	3.3%
Other natural vegetation	4,285,668	3.0%
Cloud forest	1,825,204	1.3%
Other hydrophile vegetation	1,675,939	1.2%
Mangroves	924,806	0.7%
TOTAL	**141,812,627**	100.0%

Source: SEMARNAT (2006)

INEGI developed a series of maps to illustrate conditions and changes in natural vegetation and land use in Mexico. A map of potential vegetation shows the original vegetal cover that existed before human interventions altered natural ecosystems, while other maps show actual land use in 1976, 1993, and 2002 (referred to as series I, II, and III, respectively).

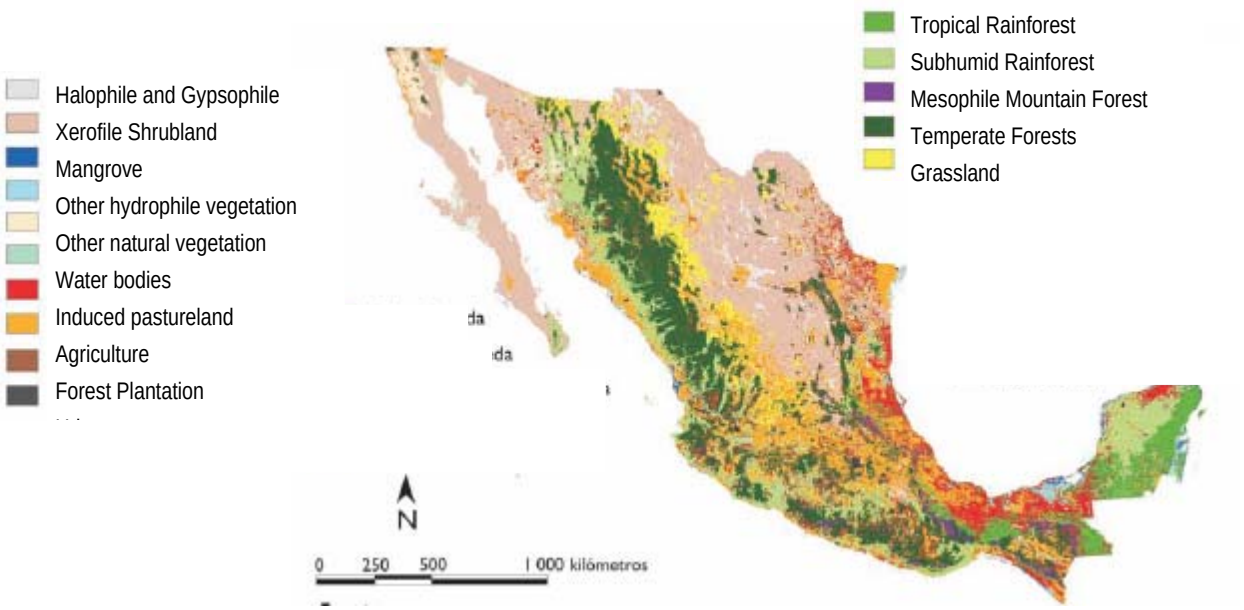
INEGI's maps point at both loss of vegetation cover as a result of ecosystem transformation and the degradation of existing ecosystems. Maps 2 and 3 provide a comparison of potential vegetal cover with the most recent data on actual land use in Mexico. As these maps indicate, human activities, including agriculture and induced pasturelands, have significantly transformed Mexico's ecosystems, particularly rainforests and mesophile forests.

Map 2. Potential Vegetation Cover



Source: INEGI (2005)

Map 3. Actual Land Use (2002)



Source: INEGI (2005)

SEMARNAT estimates that more than 10 million ha of natural vegetation were lost between 1976 and 2002. During this period, the surface devoted to agriculture and livestock grew by approximately the same area, making apparent the role of agriculture and livestock as the main drivers of land use change in Mexico (Table 2). The expansion of these activities at the expense of natural ecosystems was largely the result of public policies supported by Mexico's Federal Government, as discussed in Section 6 of this document.

In terms of the status of existing vegetation, INEGI's data demonstrate the growth of secondary vegetation as a result of the removal of primary (original) vegetation (Table 2). This trend is troubling because primary vegetation has a more important role in biodiversity conservation and the provision of environmental services.

Table 2. Land Use Change in Mexico (1976 - 2002)

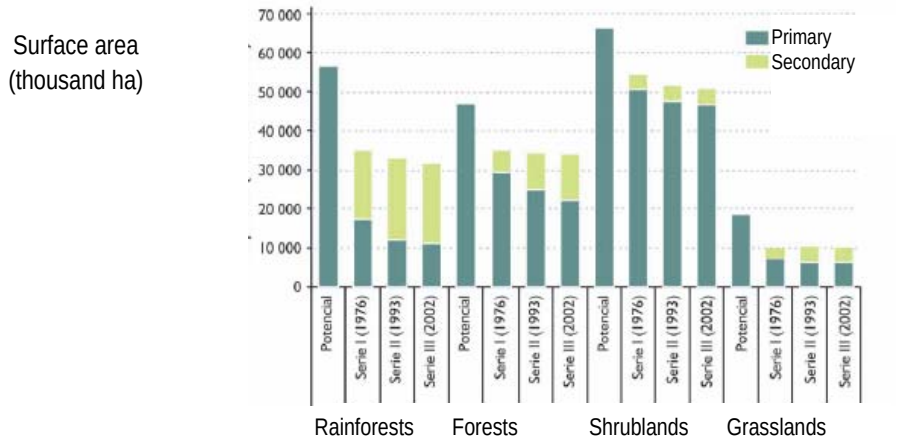
Type of Vegetation or Land Use	**Data from 1976**	**Data from 1993**	**Annual change rate 1976-1993 in ha (%)**	**Data from 2002**	**Annual change rate 1993-2002 in ha (%)**
Primary vegetation	120 456 006	104 371 891	-946 124 (-0.8)	99 659 143	-523 639 (-0.5)
Secondary vegetation	32 363 686	40 476 320	+477 213 (+1.5)	42 153 484	+186 351 (+0.5)
Total Vegetation	**152 819 692**	**144 848 211**	**-468 910 (-0.3)**	**141 812 627**	**-337 287 (-0.2)**
Induced pastureland	14 319 097	17 724 967	+200 345 (+1.4)	18 901 465	+130 722 (+0.7)

Savanna vegetation		170 904	N/a	144 090	-2 979 (-1.7)
Induced forests	30 622	25 464	-303 (-1.0)	36 701	+1 249 (+4.9)
Agriculture	26 032 725	29 085 988	+179 603 (+0.7)	30 929 364	+204 820 (+0.7)
Water Bodies	857 756	1 405 064	+32 195 (+3.8)	1 352 992	-5 786 (-0.4)
Urban Areas	199 948	1 108 232	+53 429 (+26.7)	1 259 321	+16 788 (+1.5)
Total Land Use	**41 440 148**	**49 520 619**	**+475 322 (+1.1)**	**52 623 933**	**+344 813 (+0.7)**
TOTAL	**194 259 840**	**194 368 830**	**----------**	**194 292 470**	**----------**

Source: SEMARNAT (2006)

Ecosystem transformation and degradation have affected most of Mexico's ecosystems. However, these phenomena have been more significant in ecosystems in rainforests and mesophile forests. For most ecosystems with these vegetation types, primary vegetation constitutes today only a minor fraction of the original area (Figure 1).

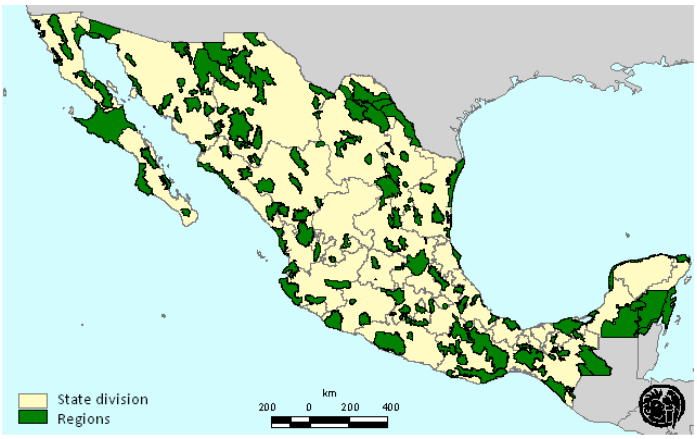
Figure 1. Evolution of Main Vegetal Formations in Mexico



Source: (SEMARNAT, 2006)

The National Commission for the Knowledge and Use of Biodiversity (CONABIO) has identified 152 terrestrial priority conservation areas, covering an area of 515 558 km^2 or roughly one quarter of Mexico's territory (Map 4). CONABIO's approach is based on three criteria, namely: ecosystemic importance, ecological integrity, and feasibility of conservation efforts.

Map 4. Terrestrial Priority Conservation Areas



Source: CONABIO http://CONABIOweb.CONABIO.gob.mx/metacarto/imagen.pl?img=165

SEMARNAT's assessment and CONABIO's classification of priority conservation areas indicate that ecosystems in meshophile forests and rainforests are a conservation priority. Land use change and ecosystem fragmentation have been more severe in these areas, which constitute the habitats of a significant portion of Mexico's biodiversity.

• Mexico's Forests

Mexico has a total forest surface of 64 million ha, which makes it the country with the 12th largest forest surface in the world, and the third in Latin America after Brazil and Peru (FAO, 2005). SEMARNAT has identified four types of forest vegetation in Mexico, which include 23 ecosystems (SEMARNAT, 2006). Forests cover approximately 34.5% of the country, and are categorized as rainforests (49.4%), temperate forests (47.9%), mesophile (or cloud) forests (2.6%), and other riparian rainforests and forests.

Temperate forests of pine, oak and sacred fir are found high up in the mountains where pines and oaks have diversified. Mexico is home to 50% of the species of pine (72) and 70% of the oaks (150). The mesophile forests in the middle and most humid part of the mountains are characterized by their arborescent ferns and the presence of epiphytes. Mesophile forests have the greatest diversity of species by coverage, with 3,000 species of plants with flowers in a potential area of 1% of the country, as well as a level of endemism of 13% in terms of genus (SEMARNAT, 2006).

The high evergreen rainforests have the highest density of wildlife species of all terrestrial ecosystems. The Lacandona rainforest constitutes the largest remaining expanse of evergreen rainforests and harbors 22% of the country's biodiversity, including 50% of butterflies, 46% of birds, and 26.8% of mammals found in Mexico (SEMARNAT, 2006).

Mexico's deforestation rate is one the highest among countries with large forest areas. According to CONAFOR, net deforestation averaged 348,000 ha/year during 1990-2000, and 260,000 ha/year during 2000-2005 (SEMARNAT, 2007). As mentioned before, land use change and ecosystem fragmentation has been particularly severe in rainforests and mesophile forests. In ecosystems such as the medium sub-deciduous forest and low thorn forest, preserved primary vegetation is a minor share of the original vegetal cover (Table 3).

Table 3. Evolution of Primary Vegetal Cover in Mexico

Vegetation Type	Ecosystem[3]	Potential Vegetation (ha)	Primary Vegetation 1976 (ha)	Primary Vegetation 1993 (ha)	Primary Vegetation 2002 (ha)	% of potential vegetation preserved as of 2002
Tropical Rainforest	High evergreen forest	9,833,140	2,468,946	1,729,624	1,418,533	14.43
	High sub-evergreen forest	100,035	92,470	62,155	60,866	60.85
	Medium evergreen forest	[a]	1,182	285	285	---
	Medium sub-evergreen forest	7,811,775	3,739,829	1,717,840	1,628,892	20.85
	Low evergreen forest	78,306	61,335	55,452	42,398	54.14
	Low sub-evergreen forest	[a]	[a]	[a]	[a]	----
Subhumid Rainforest	Medium deciduous forest	975,425	85,399	143,081	138,378	14.19
	Low deciduous forest	20,540,764	8,218,153	6,962,039	6,649,422	32,37
	Subtropical shrubs	3,787,854	1,495,300	999,664	1,012,364	26.73
	Medium sub-deciduous forest	6,224,708	825,641	544,792	419,283	6.74
	Low sub-deciduous forest	49,666	65,914	48,380	40,770	82.09
	Low thorn forest	4,292,140	345,411	220,832	243,456	5.67
	Sub-evergreen thorn forest	1,432,078	1,321,965	431,976	438,360	30.61
Mesophile Forest	Montane mesophile forest	3,088,256	1,188,413	1,002,038	869,507	28.16

[a] Not included in INEGI's maps

Source: SEMARNAT (2006)

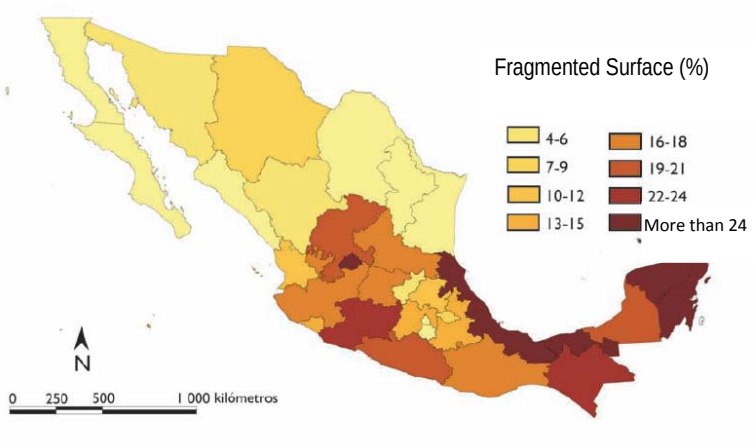
Other sources that use different methodologies and concepts estimate higher deforestation rates. A previous Food and Agriculture Organization (FAO) assessment estimated Mexico's deforestation rate between 1990 and 2000 at 631,000 ha/year. In this regard, SEMARNAT stresses that most estimates concur that deforestation rates remain alarmingly high, but that they have fallen over the last years,

[3] Rainforests are classified based on the height of their trees (high: >30m; medium: 15 - 30m; and low: 4 – 15 m.) and the percentage of species that shed leaves during dry season (evergreen: <25%; sub-evergreen: 25 – 50%; sub-deciduous 50 – 75%; and deciduous: >75%).

arguably due to changes in the legal and institutional framework, as discussed in Section 6 of this document (SEMARNAT, 2006).

Around 67% of Mexico's forests are fragmented, which results in reduced quality and quantity of wildlife habitats. Available information, which is outdated or inferred from global assessments, indicates that fragmentation is more severe in Mexico's southern states, including Veracruz, Tabasco, Yucatan, Quintana Roo, Michoacan and Chiapas (Map 4).

Map 5.Forest Ecosystem Fragmentation by State



Source: *Inventario Forestal Nacional Periódico 1994.*

• Aquatic ecosystems

The combination of climate, rough topography and complex geological formations has resulted in a broad diversity of wetlands in Mexico. The country has registered 123 wetlands as Ramsar Sites, and about a dozen more will be registered shortly, according to the National Commission of Natural Protected Areas (CONANP). Ramsar sites in Mexico are spread over an area of 8,118,927 ha (CONANP, 2008; Ramsar, 2008), and include, *inter alia*, Ria Lagartos, Cuatrociénagas, La Encrucijada, Marismas Nacionales, Centla Swamps, the Río Colorado Delta, Montebello Lagoons, and Sian Ka'an.

Wetlands exceed all other land types in terms of wildlife productivity per area, and provide critical habitat for several hundred threatened and endangered species in Mexico (Payne, 1992, IUCN 2008). Wetlands provide multiple direct biodiversity values (including fish, wild foods, medicinal plants and habitat) and also sustain critical indirect biodiversity values through ecosystem services such as water storage and recharge, water filtration, nutrient cycling and microclimate buffering (Groom *et al*., 2006).

• Continental wetlands

Most freshwater ecosystems in Mexico are rivers (68.2%); the rest are distributed in aquifers (11.7%) lakes and lagoons (2.3%), and reservoirs (17.8%) (Arriaga *et al*., 2000b). Freshwater ecosystems have the greatest number of species per unit of area, slightly more than their terrestrial counterparts and 15 times more than marine ecosystems (Carabias and Landa, 2005). Lake Chichankanab and the Lerma-Santiago basin are particularly noteworthy for their high level of endemisms (85 and 66% respectively) (CONABIO, 1998).

Some of the lacustrine wetlands have specific flora such as bulrushes (*Typha*, *Scirpus*, *Cyperus*), reeds (*Phragmites*, *Cladium*) and water hyacinth (*Eichhornia crassipes*), e.g. lakes Cuitzeo, Chapala and Pátzcuaro. There are also systems with high salinity, due to intense evaporation, such as Salada Lagoon (Baja California) and Mayrán Lagoon (Cohauila). A special case is Cuatrociénagas (Cohahuila), with gypsum rocks, and endemic fauna and flora (Conanp, 2006).

The palustrine wetlands comprise swamps with shrub- or grass-like vegetation, wooded wetlands, and temporarily or permanently flooded forests and jungles. In particular, Tabasco and Campeche include zingiberales on high herbaceous floodplains (*Calathea, Thalia, Heliconia* and some graminoids). There are also flood-prone low rainforests in Tabasco, Campeche and Quintana Roo, and seasonally-flooded riverside forests, palms (*Attalea*, *Roystonea*) and palmettos (*Acoelorrhaphe*). Most of these vegetation types have a significant role in transition between terrestrial and aquatic ecosystems, and influence both ecological dynamics. They usually support specific fauna and give refuge to aquatic and terrestrial species for reproduction.

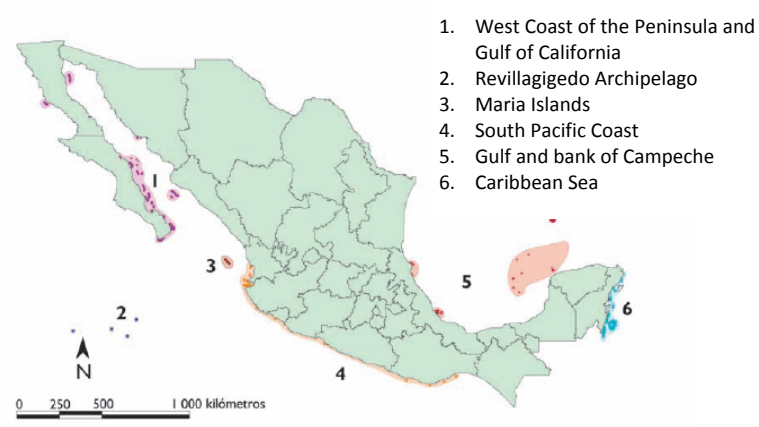
• Marine and coastal wetlands

Marine and coastal wetlands are a major component of the country's megadiversity as their physiography creates an extensive littoral with a large variety of environments. In these environments, the coincidence of tropical and temperate waters gives rise to a high number of marine taxonomic groups (Díaz de León-Corral *et al*., 2005), establishing considerable diversity of species and endemisms. Mexico's littoral is approximately 11,122 km long, includes 17 states and 150 municipalities (15% of the associated domestic population) and nearly 130 lagoon systems. There are four regional seas: the Pacific, the Gulf of California, the Gulf of Mexico and the Caribbean Sea. Mexico's Exclusive Economic Zone has more than 3 million km^2.[4] The marine environment is 1.6 times that of the terrestrial environment and possesses the world's only exclusive sea: the Gulf of California (CONABIO, 2006).

The marine wetlands include lagoons, rocky coasts and coral reefs. Mexico is considered to have six coral reef zones (Map 6), and although little is known about their distribution in cold waters, in warm waters they extend for 1,780 km^2, comprising 0.63% of the world's area (Spalding *et al*., 2001). The Mesoamerican Reef System, which covers over 700 km along the coasts of Mexico, Guatemala, Belize and Honduras, constitutes the world's second largest coral barrier.

[4] Mexico is a Party to the Third United Nations Convention on the Law of lefines the Exclusive Economic Zone (EEZ), including its size and the rights and jurisdiction of coastal sta

Map 6. Distribution of Coral Reefs in Warm Waters



Source: Oliver J.M Noordeloos, Yusuf Y., Nayan, C. Foo and F. Shahriyah. 2004 *Reefbase: A Global Information System on Coral Reef*: www.reefbase.org

Important among coastal or estuarine wetlands are tidal marshes, deltas, coastal lagoons, inlets, estuaries and bays, rocky zones, dunes, and mangrove swamps (see 2.2.4.3), as well as beaches, where a significant portion of Mexico's tourism industry has developed. A particular kind of coastal wetland is the cay, characteristic of the coasts of the Yucatan peninsula, formed by isles of vegetation (herbaceous and even dwarf mangroves) amidst a mangrove matrix. On the coasts of the northern Pacific, though to a lesser degree than in the Gulf and the Caribbean, there are saline and brackish marshes that extend from Sonora down to Chiapas and Quintana Roo. There are also salt plains on soils with high salinity and specific flora, often influenced by tides in Tamaulipas and Veracruz.

Mexico's coastal and marine wetlands support the country's fisheries industry, which is among the 20 largest in the world. Annual production oscillates between 1.35-1.57 million tons, mostly from minor pelagic fish, such as sardine and anchovies (34% of total production), tuna (9%) and shrimp (7%). CONABIO classified coasts based on their physical, biological and climatic similarity, and domestic oceans according to their currents and water masses. Based on this effort, CONABIO identified 70 priority marine conservation areas, including 23 littoral regions, 33 neritic-littoral regions, nine oceanic regions and five neritic-oceanic regions (Arriaga *et al.*, 1998) (Map 7).

Map 7. Marine Priority Conservation Areas

Source: CONABIO http://CONABIOweb.CONABIO.gob.mx/metacarto/imagen.pl?img=100

- ## Mangrove swamps

Mexico possesses some of the largest tracts of mangroves in the world. These ecosystems are of great importance due to the environmental services they provide and because of their high vulnerability to disturbances. Mangroves carry out critical functions related to the regulation of fresh water, nutrients, and sediment inputs into marine areas. They are important carbon sinks and provide protection against erosion and buffering of the effects of severe meteors and floods. In Mexico, mangroves are distributed within coastal lagoons, inlets and deltaic systems of the coasts of the Gulf of Mexico and the Pacific Ocean. The most characteristic species are *Rhizophora mangle* (red mangrove), *Avicennia germinans* (black mangrove), *Laguncularia racemosa* (white mangrove) and *Conocarpus erectus* (buttonwood mangrove). Owing to variations in tides, composition of substrate, action of the waves and salinity, their structure and productivity varies greatly.

The estimation of mangrove area varies depending on methodology (*cf*. FAO, 2007; CONABIO, 2008); by 2002, SEMARNAT estimated that Mexico had 900,000 ha, exceeding the total mangrove area in Africa, with the exception of Nigeria, and of the Americas, aside from Brazil and Cuba. However, Mexican mangroves once covered nearly 1.5 million ha (Map 8) and at present they are estimated at just over 650,000 (Table 2). In 2005, the estimated rate of deforestation was 1.1%, varying between 1% and 2.5% depending on methodology, and SEMARNAT also estimated that only 40-50% of the present area would be left by 2025 if current conditions persist (INE, 2005).

Map 8. Potential and Actual Distribution of Mangroves

Source: INEGI (2005)

Table 4. Mangrove Surface by State

Region	State	Coverage 1:50,000 (ha)
North Pacific	Baja California	28
	Baja California Sur	24327
	Sinaloa	71225
	Sonora	9353
	Nayarit	66977
Central Pacific	Jalisco	2023
	Colima	3192
	Michoacán	1500
South Pacific	Guerrero	8093
	Oaxaca	15718
	Chiapas	39707
	Tamaulipas	2410
	Veracruz	34089
	Tabasco	35191
Yucatan Peninsula	Campeche	196552
	Quintana Roo	64755
	Yucatán	80528
Total		**655668**

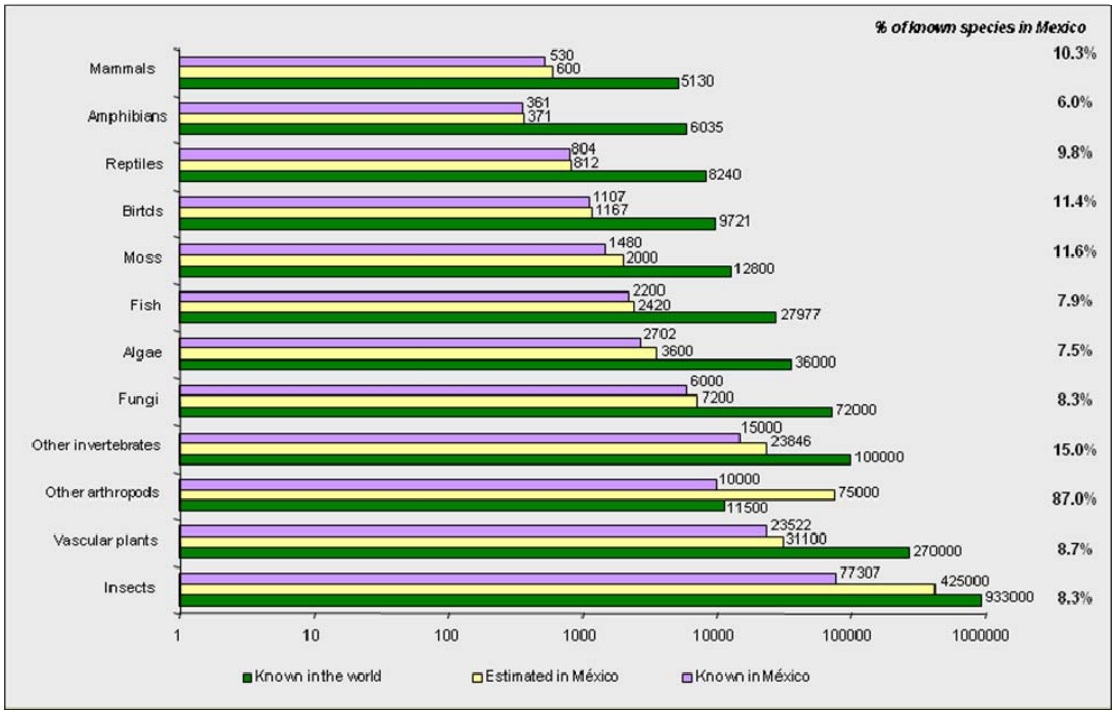
Source: CONABIO (2008)

- ## Species Diversity

Mexico is generally considered to possess between 10 and 12% of the world's known species, with much higher proportions for certain species such as the arthropods (15%) and other invertebrate

animals like worms (87%) (Fig. 2). 4800 species of bacteria have also been found in Mexico, yet it is estimated there may be more than a million of them (Grimaldi and Engel, 2005).

Figure 2. Species Diversity in Mexico and the World



Source: Modified from CONABIO (2006).

A major aspect of Mexico's biodiversity is the occurrence of biotic elements of different biogeographical origin in the same place. The occurrence of taxa of Nearctic and Neotropical origin has led to unique assemblages (Dirzo and Raven, 2003), such as the combination of boreal species like *Quercus* (oaks), *Liquidambar* with austral species like *Cecropia*, *Nectandra* and arborescent ferns in the country's southeast (Sarukán and Dirzo, 2001). Diversity is not homogenous among ecosystems and many families have diversified in Mexico, among them the Leguminosae, Cactaceae, Orchideaceae, and also some genera such as *Bursera*, *Pinus*, *Quercus*, *Tillandsia*, among others (SEMARNAT, 2006).

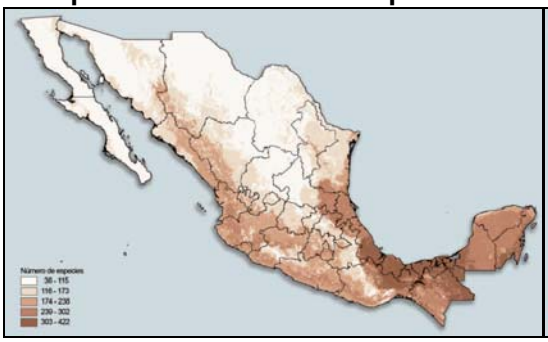
According to CONABIO's National System of Information on Biodiversity (SNIB), in the coastal and oceanic zones there are 20,796 species, 773 of which are found in the Mexican Official Standard, and 340 are endemic (SEMARNAT, 2006). Mexico is noted for the number of species of marine mammals (47), corresponding to 10.5% of the total registered worldwide. Most of them are located in the Gulf of California (75% of the country's species) (Díaz de León *et al*., 2005). These include the vaquita (*Phocoena sinus*), an endemic species in danger of extinction due to the high rate of accidental capture in fishing nets. Cetacea are the best-represented group of marine mammals (Díaz de León *et al*., 2005) with 37 species, amounting to nearly 50% of the world total. As with the rorquals, and blue, humpback and grey whales, they are migratory.

• Endemic species

Endemism is the ecological state of being unique to a place. Endemic species are not naturally found elsewhere, so they can easily become endangered or extinct because of their restricted habitat and vulnerability. Endemic species are distributed heterogeneously across Mexico, with the highest concentration of endemic species found in arid and semiarid regions, followed by a relatively smaller concentration in sub-humid tropical areas, and humid tropical regions having the lowest concentration of endemic species

Geographic areas with the highest concentration of endemic species are not necessarily those with the largest number of species. For example, the largest diversity of bird species is found in the coast of the Gulf of Mexico, while endemic bird species are primarily located along the coast of the Pacific Ocean (Maps 9 and 10). In general terms, arid and semiarid regions have the highest concentration of endemic species, but a relatively low density of species. In contrast, humid rainforests have the highest number of species per hectare, but relatively low levels of endemism. Both endemism concentration and species diversity are high in mesophile and temperate forests (Table 5).

Map 9. Distribution of Bird Species



Map 10. Distribution of Endemic Bird Species

Source: CONABIO (2006)

Table 5. Endemism by Ecosystem Type

Vegetation type	Potential Relative Coverage (%)	Species	Relative Contribution (%)	Species endemism (%)
Humid rainforest	11	5,000	17	5
Subhumid rainforest	17	6,000	20	40
Mesophile forest	1	3,000	10	30
Temperate forest	21	7,000	24	70
Natural grassland	40	6,000	20	60

Source: Modified from SEMARNAT (2006)

Between 50% and 60% of the known plants of Mexico are endemic, and the proportion is greater for some families like Cactaceae (83%) (CONABIO, 2006), and in some genera like *Pinus*, in the case of species (*P. maximartinezii*, *P. lumholtzii*, *P. culminicola*) and subspecies (*P. pseudostrobus apulcensis*, *P. pseudostrobus chiapensis* and *P. patula tecunumanii*) (Styles, 1993). Reptiles and amphibians are notable among fauna due to their high levels of endemism, 45% and 48%, respectively (Table 6).

Table 6. Endemism by Selected Taxons

	Known Species	Endemic	%
Mammals	530	164[a]	30.9
Amphibians	362	174[b]	48.1
Reptiles	804	368[b]	45.8
Birds	1107	125[c]	11.3

Sources: [a] SEMARNAT (2006), [b] Flores-Vilela and Canseco-Márquez (2004), [c] Navarro y Gordillo (2006)

• Threatened and Endangered Species

Mexican Official Standard 059 lists 2,583 species at some level of threat or risk, plants being the most numerous group, followed by reptiles, mammals and birds. However, given the richness of species in each group, those most at risk appear to be reptiles (58%), amphibians (54%) and mammals (55%). According to the International Union for Conservation of Nature and Natural Resources (IUCN, 2008), 3,122 animal species and 402 plant species in Mexico have been included in the Red List, which identifies species at high risk of global extinction. These numbers are among the highest in the world (Table 7).

Table 7. Species in IUCN's Red List for Selected Countries

Class	Extinct	Extinct in the Wild	Critically Endangered	Endangered	Vulnerable	LR/cd	Near Threatened	Data Deficient	Least Concern	Total
Animals										
Mexico	22	6	179	222	235	3	158	299	1,998	3,122
Brazil	9	1	65	98	193	9	181	404	2,493	3,453
Colombia	3	0	79	133	217	2	160	271	2,433	3,298
Plants										
Mexico	0	2	40	75	146	8	25	18	88	402
Brazil	5	1	46	117	21	22	69	34	86	401
Colombia	3	0	31	85	107	4	42	11	48	331

Source: IUCN (2008)

• Genetic diversity

Specific genes or combinations of genes allow individuals to tolerate polluted conditions, exploit habitat features more efficiently, or compete better with other species. Such abilities to tolerate temperature changes, or disperse great distances, which are at least partially genetically based, may be crucial factors affecting the persistence of a species in the face of a rapidly changing climate. Preservation of genetic diversity is thus a cornerstone of biodiversity conservation (Groom *et al.*, 2006).

Mexico's genetic diversity has not been thoroughly studied, with the exception of cultivated plants. At least 118 species (70 genera, 39 families) of plants with economic value have been domesticated in Mexico since pre-Hispanic times (Hernández X., 1993), to produce food, drinks, compost, condiments, stimulants, fiber, rubber, waxes and pigments. Some species have their origin in southern Mexico and part of Central America, such as the chili, amaranth, sunflower, cacao, cotton, jojoba, vanilla, chia, avocado, pawpaw, Mexican marigold, sweet potato, sapodilla, maguey, sisal and yam bean, among others.

There are records of the use of corn dating back over 6,000 years (Piperno and Flannery, 2001). Currently, 40 varieties are grown (CONABIO, 2006), and wild species still exist (teosinte); *Zea perennis* and *Z. diploperennis* are endemic and perennial, while *Z. mays* is annual. Additionally, there are two endemic subspecies, *Z. mays parviglumis* and *Z. mays mexicana* (Sánchez and Ordaz, 1987; Sánchez and Ruiz-Corral, 1997). In particular, *Z. diploperennis*, discovered only 40 years ago in the state of Jalisco, is infertile with cultivated corn, but only in its perennial habitat and it is restricted to disturbed areas by humans (Iltis *et al.*, 1979).

There are 63 species of the common bean (*Phaseolus vulgaris)* worldwide. 52 of these are found in Mexico, but only five of them are cultivated (CONABIO, 2006). There are several magueys (*Agave*), used in the production of tequila, mezcal and pulque. There are also domesticated ornamental plants, used in holidays and rituals, such as the Mexican marigold (*Tagetes erecta*) used for day of the dead, and the poinsettia (*Euphorbia pulcherrima*).

Mexico has five cultivated species of chili pepper, *Capsicum baccatum*, *C. chinense*, *C. pubescens*, *C. frutescens* and *C. annuum*, although around 120 varieties are grown (CONABIO, 2006), adapted to the country's diverse climates and soil types, at altitudes ranging from sea level and up to 2500 masl. *C. annum* is among the most important species, since it groups together the greatest diversity, both cultivated and wild. Mexico is considered the main center of the chili pepper's genetic diversity, although few studies have been done on the subject. The substitution of the crops of Creole varieties for improved ones poses a risk of losing the species' wealth of Mexican germplasm, i.e., the disappearance of the genetic diversity of one or many varieties which are no longer grown.

Mexico's contribution to domesticated breeds is small. It has produced 12 breeds of six species: two of horses, three of pigs, one of goats, four of sheep and two of bovine cattle. The hairless Xoloizcuintle dog is widely known for its significance to pre-Hispanic cultures, in which it was used for food and for company.

A genetic bank network has been established through the collaboration of governments, academic institutions and NGOs. The network focuses on species of economic importance, including seeds for cultivation, fruit trees and pine varieties, which constitute the largest share of germplasm ex-situ. The

network is integrated by 37 genetic banks throughout the country. In addition, there are 90 botanical gardens, zoos and aquariums in the country. There is no available information of the genetic banks managed by universities or research centers.

• Ecosystem Services

Ecosystems provide a wide range of services that are essential for life, including acting as carbon reservoirs, regulating hydrological flows, preserving the quality of water in hydrological basins, preventing the erosion and sedimentation of water bodies, preventing landslides and floods, providing a habitat for diverse species and offering special sites for tourism and cultural activities, among others. There is little information on most of these ecosystem services. In fact, only recently have the Government of Mexico and other stakeholders initiated efforts to improve the knowledge base of these services and promote their valuation. Most of these efforts have focused on carbon storage and uptake and the provision of hydrological services.

Mexico's potential for carbon uptake is estimated at 24,513 million tons per year. Around 54% of this amount corresponds to temperate forests and 45% to tropical forests (the contribution of commercial plantations is marginal and the study does not take into account the role of soils and forests). The state of Chiapas has the largest carbon storage potential, followed by Oaxaca, Michoacán, and Guerrero. Taking into account these estimates, as well as prices in the international carbon market, the carbon stored in natural ecosystems is valued at $600/ha in temperate deciduous forests, $1,800/ha in tropical deciduous forests, $3,000/ha in temperate forests, and $3,600/ha in tropical evergreen forests (Torres and Guevara, 2005).

Water capture in forested areas is estimated to represent 48,028 million m^3/year. Roughly 75% of this amount is captured by tropical forests and the remaining 25% by temperate forests. The states with the largest water capture potential are Chiapas, Oaxaca, and Quintana Roo, which together capture around 42% of the estimated total amount.

Deforestation and habitat degradation have reduced the capacity of ecosystems to provide protection against floods, landslides and other natural disasters. Between 1980 and 1999, cyclones and storms were associated with economic costs of around $700 million/year, as well as with the significant loss of lives. During this period, hydro-meteorological events caused damages equivalent to more than $4.5 billion, or 44% of total damages. Climate change models predict that extreme weather events will intensify in the future. In this context, the loss of ecosystem integrity would likely result in reduce resilience to climate change.

• Markets and natural resources

Although agricultural, livestock, forestry, fisheries and hunting have contributed only around 3.5% of Mexico GDP over the last few years (INEGI, 2008), natural resources represent a pillar of Mexican employment and livelihoods. However, these productive activities have had significant negative environmental effects. Estimates from INEGI show that the annual economic costs of natural resources depletion (including petroleum, timber, soil, and water) are equivalent to around 9% of GDP.

Over the last few years, the number and importance of economic activities that are based on the sustainable use of natural resources have increased. Although these efforts remain modest when compared with traditional agricultural and livestock activities, they illustrate the range of activities that landowners can pursue to improve their economic conditions while also contributing to protect biodiversity (Table 8).

Table 8. Benefits generated by the sustainable use of wildlife

Activity	Value (US$)
Intensive plant and animal facilities (nurseries, zoos, etc.)	8,338,592.65
Regulated hunting activities	34,808,206.28
Use of canaries and other birds	216,210.76
Legal live plant and animal exports	412,196.41
Whale watching and swimming with whale sharks ecotourism	2,426,216.14
Federal revenues (taxes)	267,240.00
Total	46,468,662.24

Source: CONABIO (2006)

SOCIAL AND ECONOMIC CONTEXT

• Land ownership in Mexico and local organizations

Ejidos and communities own 80% of Mexico's forests.[5,6] Only in Papua New Guinea, do communities own a larger percentage of natural forests (97%) and, among countries with large forest areas, communal forest ownership is significant only in China (55%), Colombia (46%), and Peru (33%). Governments administer the majority of forests in various countries, including the Russian Federation (100%), Canada (93.2%), and Brazil (77%). Individuals and firms own the major share of forests in Sweden (79.8%), Japan (58.2%), and the United States (56.3%) (White and Martin, 2002).

Ejidos and communities are generally integrated by a combination of commonly-owned land and individual parcels. *Ejidos* and communities have not always been able to agree on how to develop projects in commonly-owned land. Reforms to the Mexican Constitution and Agrarian Law in 1992 defined the mechanism through which shared land can be divided, and also relaxed restrictions on the use and transactions of *ejido* and community land. These reforms have facilitated agreements among *ejido* and community members to develop forestry projects in shared land, particularly when these projects are more profitable than dividing the land to develop agricultural activities (Muñoz, 2003).

Ejidos and communities face significant challenges to develop sustainable forestry projects. However, successful experiences across the country indicate that forests can become engines of growth for rural communities. For example, municipalities with successful *Empresas Forestales Comunitarias* (Community Forest Enterprises) (EFCs) in Oaxaca are among the least impoverished of the more than 500 municipalities in the state (Chapela, 2005). Reduced impoverishment in localities with EFCs stems from the fact that they create jobs, diversify the economic activities of *ejidos* and communities, invest in infrastructure (roads, schools, clinics, etc.) for the locality, organize to use a range of forest resources and market them as a single company and not as several small producers, invest to give added value to forest products and generate vertical integration in the chains of production, share profits among the members of the community, keeping the entire economic value of the company's activities in the locality as social and monetary investment, and generate human capital by employing the people of the region, training and involving them in technical, administrative and managerial activities.

Ejidos and communities play a crucial role in biodiversity conservation and sustainable use. The Forest Stewardship Council (FSC) has certified 40 community-based forestry projects in Mexico, the largest number in the world. To certify a project, FSC requires the community to establish conservation lands, develop biological inventories, identify threatened or endangered species, and develop a conservation

[5] Numerous sources indicate that 80% of Mexican forests are in the hands of *ejidos* and farming communities, although some authors have noted that this figure is based on a 1980 study from INEGI that lacked empirical data and did not specify the criteria used to define forests (Barton and Merino, 2004).

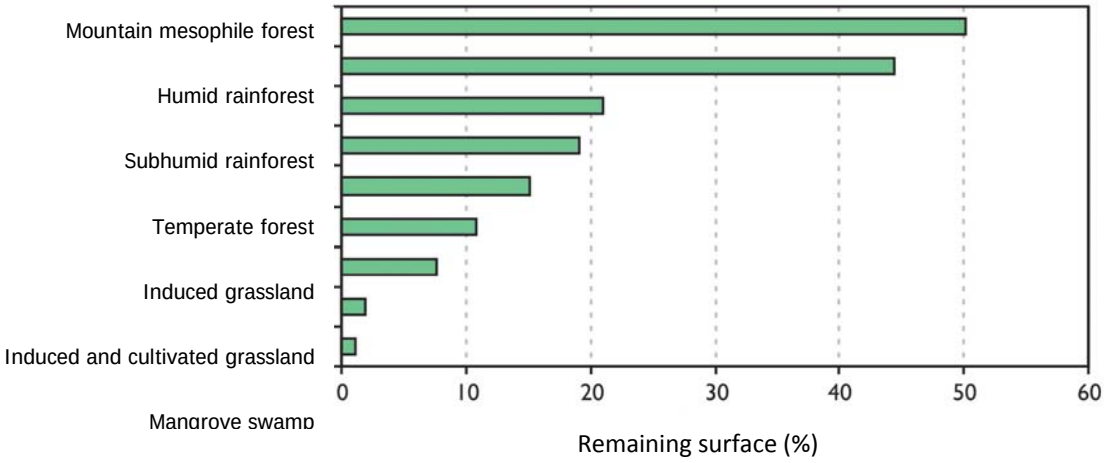
[6] Historically, *ejidos* were created when the government awarded land to a group of individuals to create a new community. The term "community" refers to the government's recognition of an existing community or restitution of land to them.

strategy (Anta, 2007). In addition, *ejidos* and communities have established different types of voluntary conservation areas. As of September 2008, CONANP had registered 177 areas, covering an area of 207,887 ha in the lands of communities and *ejidos* that had voluntarily requested CONANP's certification.

• Indigenous Groups and Biodiversity

An estimated 19 million hectares of natural vegetation are located in areas with important populations of indigenous groups. These areas include significant portions of ecosystems that support Mexico's unique biodiversity and provide crucial environmental services, including mesophile forests and humid rainforests (Figure 3).

Figure 3. Remaining Vegetation Located in Indigenous Territories



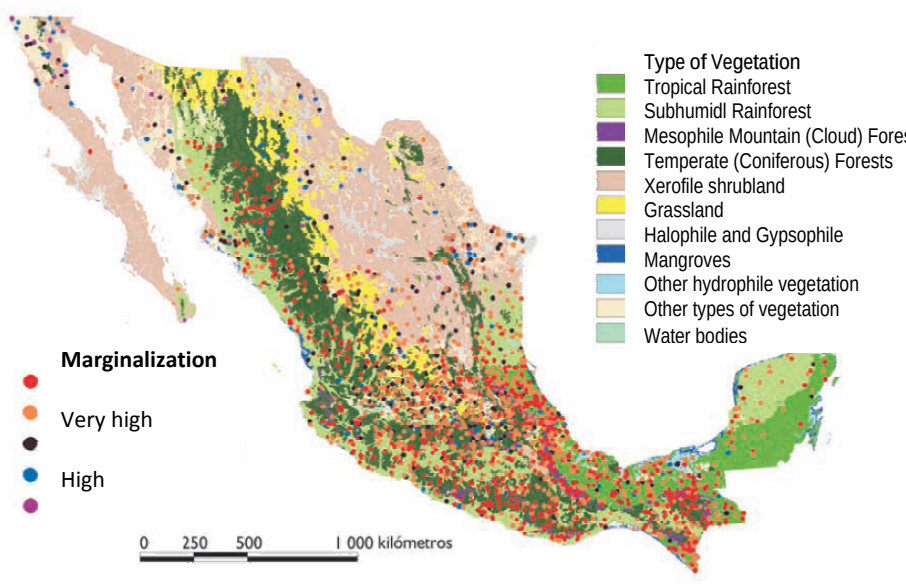
Source: Boege (2005), Semarnat (2006).

Some authors argue that indigenous groups have fostered biodiversity by selecting, and at least in part, domesticating a large number of species. Moreover, by regularly using a varied set of products of the natural ecosystems, their management systems tend to be diversified or, at least, avoid complete land use change (Boege, 2005).

• Poverty and natural resources management

According to INEGI's figures, 47% of the country's population (or 48.9 million people) were poor in 2004. Although the majority of poor people live in urban areas (26.4 million), those in rural areas face extreme poverty, meaning they lack the means to satisfy their nutrition needs. Poverty levels are particularly high in areas that were once covered by forests (Map 11). Almost 50% of the people living in areas that were once covered by tropical rainforests live in settlements with high or very high levels of marginalization. In areas corresponding to subhumid rainforests, 35% of the population is in that situation and 60% in regions originally covered by mesophile forests.

Map 11. Marginalization and Potential V



Source: SEMARNAT (2006)

Municipalities with a high proportion of indigenous population are also those with the lowest human development indexes and the highest poverty levels. A considerable portion of the best preserved forests and tropical forests and the high part of the water catchment basins of the country's main rivers are located in those same areas.

- ## Resources-related conflicts

Conflicts associated with use of, and access to, natural resources happen frequently and at different scales. Such conflicts are largely associated with a tension between conservation and development goals. Approximately 66% of the area under protection status belongs to *ejidos* and indigenous communities, with a population of over 1.3 million people. For those communities and *ejidos*, their lands' protection status translates into restrictions for the development of traditional economic activities (such as agriculture and livestock) but not always into opportunities to appropriate benefits from protecting biodiversity. In numerous occasions, illegal settlers looking for agricultural lands have invaded protected areas, including Montes Azules in Chiapas, Los Tuxtlas in Veracruz, the Sierra Gorda in Queretaro, and the Monarch Butterfly Sanctuary in Michoacan and the State of Mexico.

Laws and regulations aiming to ensure that forests are protected and used sustainably also impose constraints to owners of forested land. Given the high levels of marginalization in many forest areas, these constraints are often perceived as imposing a burden on groups that already face poverty and difficult conditions.

However, not all conflicts necessarily involve indigenous or vulnerable groups. A recent, widely covered conflict emerged when the local government of Tulum adopted an urban development plan in May 2008 that contemplates the development of hotels and real estate in an area that is part of a federal natural protected area. A ruling of Mexico's Supreme Court will determine what happens in Tulum.

INSTITUTIONAL FRAMEWORK AND GOVERNMENT EFFORTS

Environmental protection and natural resource management are highly centralized in Mexico. Decentralization has been a key issue in Mexico's environmental agenda at least since 1994. However, states have been reluctant to assume environmental management responsibilities because they are not matched with increased budget allocations. Thus, the Federal Government continues to exercise most of the regulatory and promotion functions. For this reason, this section focuses on the federal institutional and legal framework for environmental management and natural resource management.

• Institutional Framework

During most of the twentieth century, governmental regulation of the use of natural resources focused on increasing agricultural, fisheries, and forest production. Investments in water resource management were geared towards the construction of large dams and infrastructure to supply water to agricultural uses. Environmental criteria were absent in this programs, and in fact, many governmental programs had devastating environmental effects. For example, a National Clearance Commission was created in 1972 to promote clearing of all forests and rainforests (SEMARNAT, 2006).

In 1994, the Ministry of Environment, Natural Resources and Fisheries (SEMARNAP) was established with the aim of promoting environmental protection and sustainable management of natural resources in an integrated manner.[7] The Ministry is a purely normative entity, as it focuses mostly on regulating access to, and use of, renewable natural resources. Other sectoral entities, such as CONANP, carry out conservation activities. Table 9 describes the main functions carried out by different units and entities of the Federal Government's environmental sector.

[7] Competence over fisheries was transferred in 2000 to the Ministry of Agriculture, Livestock, Rural Development, Fisheries, and Food (SAGARPA). As a result of this change, SEMARNAP was transformed into the Ministry of Environment and Natural Resources (SEMARNAT).

Table 9. Mandates of Federal Government Environmental Entities

Area	Mandate
Ministry of Environment and Natural Resources (SEMARNAT)	Protection, restoration, and conservation of eco-systems, natural resources, and environmental goods and services; regulation and administration of federally-managed natural resources, except for oil, hydrogen carbides, and radioactive minerals.
Undersecretary of Planning and Environmental Policy of SEMARNAT	Environmental planning, definition of environmental policies, mainstreaming in other sectors of the federal government, compilation and analysis of environmental data
Undersecretary of Environmental Regulations of SEMARNAT	Elaboration of technical norms (NOMs), bills and regulations.
Undersecretary of Environmental Management of SEMARNAT	Issuance of permits and licenses, including those related to wildlife, forests, EIA, wastes and air emissions
National Commission of Natural Protected Areas (CONANP)	Manage natural protected areas and implement sustainable regional development programs in areas of high biodiversity
National Institute of Ecology (INE)	Conduct scientific and technical research to guide the design, implementation, and evaluation of environmental policies and programs
National Water Commission (CNA)	Manage and preserve national waters to achieve their sustainable use
Federal Attorney General for Environmental Protection (PROFEPA)	Enforce legal dispositions governing environmental pollution, restoration of natural resources, preservation and protection of forest resources, wildlife, endangered species, coastal zones, natural protected areas, EIA, and regional development plans
National Forestry Commission (CONAFOR)	Support productive, conservation, and restoration activities in the forestry sector; participate in the development and implementation of policies and plans for sustainable forestry development
Mexican Institute for Water Technology (IMTA)	Conduct research to improve water management and develop technologies to improve water allocation and enhance water use efficiency
National Commission for the Knowledge and Use of Biodiversity (CONABIO). Inter-agency commission chaired by the President and integrated by the 10 Ministries, including SEMARNAT. The Secretary of SEMARNAT is CONABIO's Technical Secretary and provides most of CONABIO's funding.	Integrate and update the National System on Biodiversity Information (SNIB); carry out research on knowledge and use of biodiversity; advise governmental agencies and other sector; help comply with international conventions (particularly CBD), and disseminate knowledge on biological wealth.

Source: Authors, based on information from SEMARNAT's Internal Regulations

Environmental Sustainability is one of the five main pillars (*ejes rectores*) of The National Development Plan (NDP) 2007-2012, which guides the Federal Government's programs and actions. In line with the

NDP, SEMARNAT has aimed to coordinate its efforts with those of other sectoral agencies, particularly to address cross-sectoral challenges (including climate change, sustainable tourism development, and adoption of Environmental Management Systems by the public administration), as well as to protect priority areas (including the Lacandona Rainforest, coastal areas and the Mesoamerican Biological Corridor). The Cross-sectoral agendas (*Agendas de Transversalidad*), have helped to mainstream environmental criteria in the activities of an important segment of the Federal Public Administration. Still, a number of public programs continue to foster unsustainable use of natural resources, as discussed in section 6 of this document.

• Legal Framework

Mexico has developed a comprehensive legal framework for environmental and natural resource management. The General Law of Environmental Equilibrium and Protection (LGEEPA) is the cornerstone of Mexico's environmental laws. Until 2000, few environmental laws existed and regulations complemented LGEEPA's general provisions. With Congress becoming a truly independent power, the number of environmental and other related legislation has increased notably. The proliferation of laws, regulations and official Mexican norms (currently numbering more than 100) partly reflects a growing sophistication in environmental management, but also represents challenges for environmental enforcement agencies, particularly PROFEPA, which requires additional resources to oversee their compliance. Table 10 summarizes Mexico' main environmental laws.

Table 10. Main Environmental Laws

Instrument/ Legal Hierarchy	Scope
Mexican Constitution (First tier law)	Defines environmental rights and ownership of renewable and non-renewable natural resources.
General Law of Environmental Equilibrium and Protection (Second tier law)	Framework law for environmental and natural resource management; defines the attributions of each level of government; defines environmental policy's principles and the instruments for environmental management.
Regulations of the General Law of Environmental Equilibrium and Protection in the Area of Natural Protected Areas (Third tier law)	Regulates the establishment, administration and management of federal natural protected areas.
Regulations of the General Law of Environmental Equilibrium and Protection in the Area of Environmental Audits (Third tier law)	Regulates environmental audits, which include a firm's equipments and processes, as well as the associated pollution and risks.
Regulations of the General Law of Environmental Equilibrium and Protection in the Area of Environmental Impact Assessment (Third tier law)	Regulates the Federal Government's use of Environmental Impact Assessment.
Regulations of the General Law of Environmental Equilibrium and Protection in the Area of Environmental Regional Planning (Third tier law)	Regulates environmental zoning plans at the Federal Level, including marine zones, plans covering areas of two or more states, and the definition of criteria to guide the development of plans by states and municipalities.

Instrument/ Legal Hierarchy	Scope
Regulations of the General Law of Environmental Equilibrium and Protection in the Area of Prevention and Control of Air Pollution (Third tier law)	Defines general environmental criteria for air quality management; defines Federal Government's responsibilities for air quality management, including control of pollution from federal sources, transboundary pollution, and management of air basins covering parts of two or more states.
Regulations of the General Law of Environmental Equilibrium and Protection in the Area of Emissions Registry and Pollutant Transfers (Third tier law)	Regulates the registry of emissions and discharges from selected sources to air, water, soil, subsoil, and through wastes.
General Law of Sustainable Fisheries and Aquaculture (Second tier law)	Regulates the promotion and management of fisheries and aquaculture resources.
General Law of Wildlife (Second tier law) Regulations of the General Law of Wildlife (Third tier law)	Regulate the conservation and sustainable use of wildlife and its habitat (excluding the use of timber and non-timber goods, marine species, and endangered or at risk species).
General Law for the Prevention and Integrated Management of Wastes (Second tier law) Regulations of the General Law for the Prevention and Integrated Management of Wastes (Third tier law)	Determines the responsibilities for hazardous, special, and solid waste management for the Federal, State, and Municipal Governments, respectively.
General Law of Sustainable Forest Development (Second tier law) Regulations of the General Law of Sustainable Forest Development (Third tier law)	Regulates the use and administration of forest resources; recognizes the environmental services provided by forests; aims to reduce poverty rates among forest dwellers'.
Law of National Waters (Second tier law) Regulations of the Law of National Waters (Third tier law)	Regulates use and management of water; defines responsibilities of CNA and watershed organizations; mainstreams environment into water management.
Law of Biosafety of Genetically Modified Organisms (Second tier law) Regulations of the Law of Biosafety of Genetically Modified Organisms (Third tier law)	Regulates use, trade, and experimentation with these organisms.
Law of Organic Products (Second tier law)	Regulates the criteria and requirements for the elaboration, use, verification and certification of organic products.
Law of Promotion and Development of Biofuels (Second tier law)	Establishes the requirements to produce biofuels; defines the responsibilities of Federal Government agencies in issuing permits and regulating biofuels; creates the inter-agency commission for biofuels.
Law for the Use of Renewable Energies and Financing for the Power Transition (Second tier law)	Regulates the use of renewable sources and cleaner technologies for electricity generation (excludes electricity for public use and from nuclear sources, large hydro projects, and incineration of industrial wastes).

Instrument/ Legal Hierarchy	Scope
Law for the Sustainable Use of Energy (Second tier law)	Aims to improve energy efficiency.
Law of Sustainable Rural Development (Second tier law)	Aims to improve welfare of rural communities; creates a program that provides resources to protect rural environment, enhance sustainability of rural development, and valuation of environmental services.
General Law of Public Property (Second tier law)	Regulates the concessions of the Federal Maritime and Terrestrial Zone and Lands Reclaimed to the Sea.
Law of Planning (Second tier law)	Mandates the incorporation of environmental criteria in the programs and actions of the Federal Government's administrative sectors.

Source: Authors, based on the mentioned laws and regulations

Mexico has actively participated in the development of international environmental agreements. Ratified conventions become a second tier law under Mexico's legal system. Following is a brief description of the mandatory international environmental instruments that Mexico has signed.

Table 11. Main International Environmental Treaties Ratified by Mexico

Treaty	Objective
Convention on Biological Diversity (CBD)	Aims to conserve biodiversity, foster sustainable use of its parts, and promote fair and equitable sharing of benefits arising from genetic resources.
Cartagena Protocol on Biosafety of the CBD	Focuses on the protection of biodiversity from potential risks posed by living modified organisms resulting from modern biotechnology.
Convention on the International Trade of Endangered Species of Wild Fauna and Flora (CITES)	Attempts to ensure that international trade in specimens of wild animals and plants does not threaten their survival and it accords varying degrees of protection to more than 30,000 species of flora and fauna.
Inter-American Convention for the Protection and Conservation of Sea Turtles	Sets standards for the conservation of sea turtles (which are endangered animals) and their habitats
International Whaling Commission (IWC)	Designed to provide for the proper conservation of whale stocks and thus make possible the orderly development of the whaling industry
Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar)	Establishes a framework for conservation and sustainable use of wetlands.

Treaty	Objective
United Nations Framework Convention on Climate Change (UNFCCC)	Defines the international framework for stabilization of greenhouse gas concentrations in the atmosphere; establishes differentiated responsibilities between developed and developing countries.
Kyoto Protocol of the UNFCCC	Establishes legally binding reductions of greenhouse gases for industrialized countries; defines the flexible mechanisms for emissions mitigations, including the Clean Development Mechanism (CDM). Mexico, as a developing country, did not commit to a quantified reduction target when it ratified the Protocol.
United Nations Convention to Combat Desertification (UNCCD)	Aims to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, particularly in Africa
Vienna Convention for the Protection of the Ozone Layer	Centers on the protection of human health and the environment from adverse effects resulting from human activities that modify the ozone layer
Montreal Protocol on Substances that Deplete the Ozone Layer (of the Vienna Convention)	Sets schedules to phase out the production and use of number of ozone depleting substances
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes	Aims to protect human health and the environment against the adverse effects resulting from the generation, management, transboundary movements and disposal of hazardous and other wastes
Rotterdam Convention	Promotes open exchange of information and calls on exporters of hazardous chemicals to use proper labeling, include directions on safe handling, and inform purchasers of any known restrictions or bans
Stockholm Convention on Persistent Organic Pollutants (POPs)	Attempts to protect human health and the environment from chemicals that remain intact in the environment for long periods, become widely distributed geographically and accumulate in the fatty tissue of humans and wildlife.
North American Agreement on Environmental Cooperation	Declaration of principles, objectives and measures to further cooperation on conservation and protection of the environment among USA, Mexico and Canada; side agreement to NAFTA; created the Commission for Environmental Cooperation (CEC).
Memorandum of Understanding Establishing the Trilateral Committee Canada/Mexico/United States for Wildlife and Ecosystem Conservation and Management	Provides a forum for discussions among the senior members of the Federal Governments' wildlife agencies in the three countries.

Treaty	Objective
Memorandum of Understanding between the United States Agency for International Development and the National Forestry Commission of the United Mexican States	Its purpose is to continue and expand mutual cooperation to contribute to the sustainable management and conservation of forest resources within mutually agreed upon regions within Mexican territory, and to promote scientific and technical exchanges related to conservation, environmental protection, sustainable use of natural resources, management, restoration and prevention of the deterioration of forest resources.
Memorandum of Understanding between the National Forest Commission of the United Mexican States and the State of Idaho of the United States of America	Creates a Bilateral Working Group to serve as a coordinating mechanism with the purpose of attending issues of common interest regarding forest resources and the benefits they provide.
Cooperative Agreement between the Peace Corps of the United States of America and the Ministry of Environment and Natural Resources of the United Mexican States	Establishes a program with trained volunteers from the Peace Corps to support SEMARNAT in the areas of environment, natural resources, sustainable development, and other areas.
Memorandum of Understanding on Technical and Scientific Cooperation between the *Comisión Nacional para el Conocimiento y Uso de la Biodiversidad* and the National Museum of Natural History of the Smithsonian Institute, USA.	The Parties agree to collaborate in making available, in electronic format, specimen-based data pertaining to material of joint interested deposited in the Museum.
Memorandum of Understanding between the United States Department of Agriculture and the Ministry of Environment and Natural Resources of the United Mexican States	Aims to foster greater cooperation for the protection and improvement of the environment, the conservation and the sustainable use of natural resources, and the promotion of sustainable productive activities.

Source: Authors, based on the information available at: http://www.semarnat.gob.mx/presenciainternacional/Pages/inicio.aspx

• Government Instruments and Programs

Since its creation in 1994, SEMARNAT has expanded and strengthened its instruments and programs for biodiversity conservation and sustainable use of natural resources. However, compared with the direct and indirect causes of environmental degradation, these instruments are still insufficient. Tables 12 and 13 summarize SEMARNAT's main instruments and programs, their coverage, as well as some of the main challenges that remain unsolved.

Table 12. Main Biodiversity Protection Instruments

Instrument/Implementing Agency	Description	Comments
Natural Protected Areas (ANPs) implemented by the National Commission for Natural Protected Areas (CONANP)	• Aim to conserve, protect or restore ecosystems, biodiversity and landscapes. • Government establishes ANPs by decree and CONANP manages them according to a management program that determines the type of activities that are permitted in the different parts of the ANP (core, buffer, etc.) • Government does not always expropriate land, which means that creation decree restricts the activities that private landowners can undertake in their own lands. CONANP has increasingly aimed to engage communities living within or adjacent to ANPs in projects (such as ecotourism or the construction of small infrastructure) to reduce tensions arising from restrictions imposed to landowners by governmental decrees.	• CONANP has established 166 federal ANPs, covering 23.1 million ha (roughly 11% of the country). • CONANP's budget has increased steadily from MX$147 million in 2000 to MX$581 million in 2005. • As of 2005, 84% of the ANPs were staffed, while 54.8% had adopted a management program and 30% were in the process of developing it. • CONANP began charging user fees in 2002; revenues are used to strengthen ANPs management.
Management Units for Sustainable Use of Wildlife (UMAs), authorized by the General Direction of Wildlife (DGVS) of SERMANAT's Undersecretary of Environmental Management	• Designed to help landowners generate income from the sustainable use of biodiversity in their lands. • Landowners must submit for SEMARNAT's approval a management plan that ensures the conservation of the ecosystem, its parts and the use of limited number of species that would not threaten the species' populations. Landowners must also carry out monitoring activities and periodically submit reports to SEMARNAT. • UMAs have two main modalities: extensive, which contemplates the development of free species populations; and intensive, in which species or individuals are bred in captivity. • Use of biodiversity under UMAs can either be extractive (hunting, pets, food, collect, ornaments, inputs for industry of handcrafts, etc.) or non-extractive (eco-tourism, education, research, or photography and video).	• DGVS has authorized 8,909 UMAs covering an area of 31.32 million ha (around 16% of the national territory). • Most UMAs are located in Northern Mexico, likely because owners have larger plots of land where extensive UMAs can be established. In contrast, UMAs in Southern Mexico require an agreement among number of landowners to incorporate a sufficiently large plot of land under the management program. • NGOs have argued that lack of human and financial resources do not allow DGVS to review adequately the management plans prior to their approval and impair PROFEPA from inspecting UMAs.

Instrument/Implementing Agency	Description	Comments
Ecological regional plans (*Ordenamiento Ecológico del Territorio OET*). The General Direction of Environmental Policy and Regional and Sectoral Integration (DGPAIRS) of the Undersecretary of Planning and Environmental Policy of SEMARNAT coordinates Federal OETs.	• The OET contemplates two main elements: a technical study that identifies the physical conditions of a geographic region and the uses for which the land is more suited, and a consensus-building process in which stakeholders agree on the land use for each of the region's different areas. • Responsibilities for OET are distributed among the three levels of government: the Federal Government is responsible for marine and country-wide OETs, and participates in OETs covering two or more states or a federal ANP; state governments are responsible for EOTs covering part or the whole of their territory; and municipal authorities lead the preparation of EOTs in part of or their whole territory.	• Processes for the preparation of OETs are seldom completed, mostly because of difficulties in reaching consensus among stakeholders on land uses. As of 2005, authorities had initiated 124 processes for EOT formulation, but only 34 had been adopted. • OETs are often inconsistent with other regional land use plans, particularly the urban development plans. • OETs are often ignored or modified due to economic or political reasons.
Environmental Impact Analysis (EIA). The General Direction of Environmental Impact and Risk (DGIRA) or the Undersecretary of Environmental Management reviews and approves EIAs at the federal level.	• EIA aims to establish the conditions to mitigate or avoid significant environmental impacts from the development of activities that could result in ecological disequilibrium or exceed existing pollution limits. • Project developers must describe in the Environmental Impact Report the measures they will adopt to comply with existing laws and norms, including those related to biodiversity conservation and land use change.	• Legal framework does not require EIA to contemplate alternatives for the proposed project, nor its complementary or synergistic effects. • SEMARNAT/PROFEPA have limited capacity to monitor compliance with conditions established in the EIA. • Conceptually, EIA should be use to evaluate only projects that could significantly affect the environment, with the all other activities being undertaken based on a planning exercise (e.g. through EOTs). In practice, EIA has become SEMARNAT's most important decision-making tool.

Source: Authors

Table 13. Main Federal Government Programs

Program (Spanish Acronym)	Description	Coverage
Recovery and Conservation and Priority Species (PREP). CONANP leads the activity with the support of INE, DGVS and CONABIO.	CONANP, with the support of INE, CONABIO, and DGVS, develops a project to protect and recover priority species (endemic, endangered or having ecological, economic, scientific or social importance).	Environmental authorities have adopted projects for more than a dozen species, including parrots, seals and sea lions, crocodiles and caimans, the Mexican grey wolf, bighorn sheep, manatees, black bear, and the royal eagle.
Conservation for Development (PROCODES, formerly PRODERS), implemented by CONANP	PROCODES support communities living within or around ANPs or other high biodiversity areas to organize themselves, develop regional development plans and prepare studies to develop goods and services that can be produced and sold without threatening biodiversity.	By the end of 2007, PROCODES had supported some 1,280 communities in 103 ANPs and 46 other priority regions.

Program (Spanish Acronym)	Description	Coverage
Strategic Forestry Program 2025	Provides Mexico's long-term vision and actions needed to strengthen protection, restoration, and sustainable use of forests. The Program is operationalized through CONAFOR's six-year institutional programs.	
Forestry Development (PRODEFOR)	Provides resources to help communities implement sustainable forestry management plans and to diversity their productive activities (e.g. ecotourism projects)	As of 2005, PRODEFOR was implemented in an area of more than 13 million ha.
Payment Environmental Services: Hydrological Services (PSAH) implemented by CONAFOR, with World Bank support.	CONAFOR pays landowners in priority regions for conserving their forests, which provide important hydrological services (e.g. aquifer recharge, quality and quantity of water flows, sedimentation control, etc.).	As of 2006, this program covered more than 730, 000 ha of forests.
Payment for Environmental Services: Carbon Storage and Biodiversity Conservation implemented by CONAFOR, with World Bank support.	CONAFOR pays landowners who convert from agricultural to agro-forestry systems in regions with a natural forest vocation. The aim is to enable landowners to access global markets for carbon storage and biodiversity conservation.	Landowners of more than 630,000 ha participated in the program between 2003-04.
Detection and Fighting of Fire Forests.	CONAFOR executes this program in coordination with CONABIO's satellite heat detection system and data from the National Meteorological Service, as well as with firefighters from the Ministry of Defense, Navy, and state and local governments.	Area affected by fires varies due to yearly weather variations and other factors.
Community Forestry Development (PROCYMAF) I and II, implemented by CONAFOR with World Bank support.	Supports communities, mostly indigenous groups, in conducing organizational processes that result in agreements on local development alternatives based on their forest resources. Based on these agreements, communities are well positioned to obtain resources from other programs, such as PRODEFOR and PRODEPLAN.	In the first stages, PROCYMAF resulted in 147,314 ha of certified managed forests, 271,131 ha of improved forest management, and 535,658 ha where communities adopted a forest land use plan.

Program (Spanish Acronym)	Description	Coverage
Conservation and Restoration of Forest Ecosystems (PROCOREF), implemented by CONAFOR	PROCOREF has three sub-programs: the national reforestation program (PRONARE), the program to protect, conserve and restore forest soils, and the forest sanitation program.	PRONARE had reforested about 3 million ha by the end of 2005. The program for forest soils supported protection activities in about 2.54 million ha and conservation and restoration activities in 272 thousand ha between 2001 and 2005. The forest sanitation program provided sanitation treatment to 110,431 ha between 2001 and 2005. CONAFOR intends to expand its capacity to identify plagues or diseases over an area of 600,000 has/year.
Commercial Forest Plantations (PRODEPLAN), implemented by CONAFOR	Supports the development of forest plantations in deforested areas or of marginal value for agriculture and livestock. The plantations are expected to generate employment and economic benefits, while also reducing environmental degradation in deforested areas.	PRODEPLAN aims to establish plantations over a total area of 875,000 ha by 2025. Producers had established around 150,000 ha by the end of 2006 under PRODEPLAN.
Mesoamerican Biological Corridor (MBC), implemented by CONABIO with support from the Global Environmental Facility.	Supports the protection of biological corridors, designed to avoid fragmentation and support connectivity among well preserved ecosystems. The MBC has increasingly become a mechanism to coordinate public policies and federal, state and local programs for biodiversity protection and sustainable use of natural resources.	The MBC covers over 75 million ha in southern Mexico Central America and is home to about 10% of the world's know biodiversity. The Mexican portion (MBC-M) covers five biological corridors in the states of Chiapas, Campeche, Yucatan and Quintana Roo.
Regionalization Program implemented by CONABIO	The program aims to identify biodiversity priority regions, where conservation and knowledge generating efforts should be targeted.	Regionalization efforts have been completed for priority terrestrial regions, priority marine regions, hydrological priority regions, and for priority areas for birds.
Ecosystem monitoring by CONABIO	The program uses satellite-based images of the temporal and spatial distribution of vegetation across Mexico, with the aims of assessing inter-temporal trends and enhancing understanding of natural vegetation.	The program supports the monitoring of heat points, which is updated daily to identify potential forest fires. This effort has been running since 1999 and has significantly improved firefighting efforts.

Program (Spanish Acronym)	Description	Coverage
National Strategy for Climate Change, implemented by the Inter-Secretarial Commission on Climate Change, which is led by SEMARNAT and integrated by the Ministries of Communications and Transportation (SCT), agriculture and livestock (SAGARPA), social development (SEDESOL), Economy, Energy, and Foreign Affairs (SRE). The Treasury (SHCP) is a permanent guest.	The Strategy contemplates four main strategies: preparation of a national climate change program, use of Clean Development Mechanism and other mechanisms to mitigate GHG emissions, carry out mitigation projects to conserve carbon stored in soil and vegetation, and development of biofuels.	The National Climate Change Program will determine more specific actions for climate change adaptation and mitigation. SEMARNAT has disseminated at least one draft for public comments, but the program has not been adopted yet.

Source: Authors, based on SEMARNAT (2006), www.semarnat.gob.mx, www.conafor.gob.mx, and www.conabio.gob.mx,.

The Federal Government's instruments and programs currently contribute to protect an area of over 40 million ha. However, SEMARNAT estimates that this area could expand significantly in the future.

Table 14. Area under Protection Instruments (Actual and Projected)

Area and plant formation, 2002		Accrued areas, 2006 (million ha)					Accruable areas, 2012 (million ha)					Accruable areas to 2030 (million ha)				
		ANP	UMA	SFM	PES	Total	ANP	UMA	SFM	PES	Total	ANP	UMA	SFM	PES	Total
Forests	34,16	2,0	1,4	3,4	0,2	7,0	2,3	2,4	7,4	1,1	13,2	4,5	6,3	13,8	5,0	29,6
Rainforests	32,93	2,4	1,5	1,3	0,5	6,1	2,6	2,3	3,2	1,8	9,9	6,5	5,3	10,2	7,0	29,0
Scrublands	52,88	5,8	15,5	1,4	0,0	22,7	5,9	16,4	3,3	0,1	25,7	7,5	24,4	7,0	0,5	39,4
Halophile and gypsophile	4,64	0,9	0,4	0,0	0,0	1,3	0,9	0,5	0,0	0,0	1,4	1,7	1,0	0,0	0,0	2,7
Other vegetation	17,20	2,0	2,7	0,0	0,0	4,7	2,1	2,9	0,0	0,3	5,3	2,3	3,0	1,0	2,5	8,8
Total	141,81	13,1	21,5	6,1	0,7	41,8	13,8	24,5	13,9	3,3	55,5	22,5	40,0	32,0	15,0	109,5

Source: SEMARNAT, 2007.

NGO AND DONOR PROGRAMS AND ACTIVITIES

- ## NGO Programs and Activities

A wide diversity of domestic and international NGOs currently operate in Mexico (see Table 15).

Table 15. NGO Programs and Activities

NGO	Programs and Activities
Fondo Mexicano para la Conservación de la Naturaleza (FMCN)	FMCN procures financial resources from international and private organizations to fund conservation projects. Environmental funds managed by FMCN include the Natural Protected Areas Fund (FANP), the Fund for the Conservation of the Gulf of California, and the Regional Fund for the Monarch Butterfly. It is also part of the Mesoamerican Reef Fund and the Network of Environmental Funds of Latin America and the Caribbean (REDLAC). FMCN has a good record of collaborating with USAID in projects such as the environment and competitiveness project, which includes analytical work on the linkages between competitiveness, forests and water, training of legislators on environmental issues and the Environmental Transparency initiative. (www.fmcn.org)
PRONATURA	PRONATURA is a national NGO that focuses on the conservation of priority flora, fauna and ecosystems (endangered or highly important for the proper functioning of ecosystems). PRONATURA's programs are grouped in five thematic areas: climate change; conservation of private and social lands; water; green funds; and priority species.(www.pronatura.org.mx)
The Nature Conservancy	The Nature Conservacy (TNC) has been working in Mexico since 1998. Its activities include: using cutting edge science to strengthen environmental management, working with communities to sustainably manage local natural resources, creating management plans for protected areas, controlling the spread of invasive species and helping manage uncontrolled fire. Geographically, TNC focuses on Baja California and the Gulf of California, the Chihuahua and Sonora desert, the Gulf of Mexico, Maya Forest, Mesoamerican Reef, and Chiapas (including a USAID-funded project for watershed conservation in El Triunfo). (http://www.nature.org/wherewework/northamerica/mexico/work/)
Conservación Internacional – México (CI-MEX)	CI-MEX focuses on hotspots (i.e. high biodiversity areas facing severe threats). In the Madrean Pine Oak Woodlands in northeastern Mexico and the southern US, CI works to establish natural protected areas, promote sustainable fisheries, and establish alliances with regional and local NGOs and stakeholders. In the Mesoamerican Forests of southern Mexico and Central America, CI promotes best practices in productive activities such as agriculture and nature-based tourism, as well as participatory planning and monitoring programs. CI has implemented USAID-funded projects, including the Conservation Coffee Alliance in Chiapas. (http://www.conservacion.org.mx/)

NGO	Programs and Activities
Fondo Mundial para la Naturaleza- México (WWF-Mex)	WWF-Mex implements four main programs: 1) Mexican forests, (including the Monarch Butterfly Reserve); 2) Chihuahua desert; 3) Gulf of California; and 4) Mesoamerican Reef Barrier. WWF-Mex programs focus on strengthening public policies, supporting communities to develop sustainable productive activities (e.g. fisheries, tourism, etc.); strengthening the natural protected areas system and conducting research to inform policy and project development. (http://www.wwf.org.mx/wwfmex/index.php)
Reforestamos México	Reforestamos México aims to conserve and recover forests in Mexico by developing projects in four areas: 1) forest conservation and management; 2) community forestry development; 3) public awareness and development of a forest culture; and 4) climate change. (http://www.reforestamosmexico.org)
Natura y Ecosistemas Mexicanos A.C.	Natura focuses on the conservation and restoration of the Lacandona rainforest, working jointly with environmental specialists and local communities. Its activities include development of local community capacity for sustainable use of natural resources, monitoring and recovery of endangered species, and development of applied research. (http://www.naturamexicana.org.mx)
Centro Interdisciplinario de Biodiversidad y Ambiente (CeIBA)	CeIBA is dedicated to the analysis of priority problems associated with environment and natural resources, as well as to the development of recommendations to address them. CeIBA is an expert forum for an informed dialogue on environmental policy and develops recommendations to improve environmental and natural resource policies. (http://www.ceiba.org.mx)
Rainforest Alliance (RA)	In 2008 the Rainforest Alliance initiated the Project "Transforming the management of community high biodiversity forests through the development of national capacities for market-based instruments." RA also collaborates with SEMARNAT in the Sustainable Tourism Network Project and in the certification of tourism enterprises in the State of Quintana Roo. (http://www.rainforest-alliance.org/locations/mexico/forestry.html)
Ducks Unlimited – México (DUMAC)	DUMAC's main initiative is the "Habitat Program in Mexico," which focuses on estuary restoration and improvement of winter habitats for water fowl and other species that depend on wetlands. The Continental Conservation Plan identifies 28 wetlands in Mexico that are critical for water fowl. (http://www.dumac.org/dumac/habitat/esp/index.htm)
Fundación Packard (David and Lucile Packard Foundation) (FP)	Fundación Packard's general objective is to protect marine ecosystems. It focuses on: strengthening and development of the networks of marine protected areas, improving fisheries management in those areas, and formally protecting and restoring ecologically fragile islands. FP's program focuses on three coastal ecosystems: the Coast of California, the Gulf of California and the Northwest Pacific. (http://www.packard.org/categoryDetails.aspx?RootCatID=3&CategoryID=73)
Fundación Ford (FF)	Jointly with the McArthur and Hewlett Foundations, FF implements the "Environment and Development" Program, which promotes sustainable use of natural resources in rural areas of southeast Mexico and Central America. Its work focuses on forestry and tourism. FF supports activities that promote policy improvement, institutions, and knowledge and capacity building, rather than field activities. FF has programs on Environmental Governance and Civil Society, which focus on areas such as transparency, best practices, and development of local capacities. The Economic Development and Safe Finances Program supports access from low-income people to financial services and develops managerial capacity. (http://www.fordfound.org/regions/mexicocentralamerica/overview)

Source: Authors, based on information provided by CEDEC to USAID

• Donor Programs and Activities

Various multilateral and bilateral international organizations currently support Mexico's efforts to protect its biodiversity. Resources provided by international organizations do not result in increased budgetary resources for environmental agencies, but commit the Federal Government to carry out activities agreed with such organizations.

Table 16. Donor Programs and Activities

Donor	Programs and Activities
World Bank	The World Bank has funded multiple projects to improve policies (development policy loans) and execute environmental projects. Recently completed, active and future projects include: the Environmental Sustainability Development Policy Loan (US$300.75 million) which integrates environmental principles in key economic sectors (e.g. tourism, water, energy, forests, and housing); Climate Change Development Policy Loan (US$501.25 million) to support the development of the National Strategy for Climate Change; the Integrated Energy Services (US$15 million), Sacred Orchids of Chiapas: Cultural and Religious Values in Conservation Project (US$2.1 million), the Consolidation of Protected Areas System Project (SINAP) (US10.15 million, US$5.44 million from GEF), Environmental Services Project (US$45 million), and Community Forestry II (PROCYMAF II) (US$21.3 million). (www.worldbank.org/mx)
Global Environmental Facility (GEF)	To date, GEF has awarded US$107 million in grants for biodiversity conservation through the World Bank, UNDP, UNEP and other agencies, US$143 million in the area of climate change, US$9 million for international waters, and US$17.23 million in multiple focal area projects. Mexico has also benefited from GEF's regional initiatives, including US$40.5 million for biodiversity conservation, US$26 million for climate change, US$36 million for international waters, and US$4.9 million in multiple focal area projects. (http://www.gefonline.org/home.cfm)
Inter-American Development Bank (IDB)	IDB's environmental projects have largely consisted of technical assistance to the Government of Mexico and other stakeholders. Projects include: Strengthening SME Competitiveness through Environmental Best Practices (US$180,000); Preparing the Sinaloa Sustainable Coastal Management Program ($110,000); Biodiversity Assessment for the Mundo Maya Sustainable Tourism Program Sites ($145,000); Expansion of Cleaner Production Centers (US$2.4 million), and Promotion of Cleaner Production Opportunities in the Bajio Region (US$940,000). (http://www.iadb.org/projects/)
UNDP	UNPD executes projects funded by governments or other donors. Environment and energy is one of UNDP's five strategic areas. Relevant projects include: Institutional and Technical Capacity Building for Biosafety, Integrated Ecosystem Management in support of PROCODES in 3 Priority Areas; creation of an alternative management system in the Sierra Gorda Biosphere Reserve; Consolidation of the Mesoamerican Biological Corridor in Mexico, and Support in the Preparation of Projects for GEF Grants. (http://www.undp.org.mx/)
UNESCO	UNESCO's " Man and Nature Program" proposes an interdisciplinary agenda for research and development of capacities that aim to improve the relationship of people to their environment. The program uses a global network of Biosphere Reserves as means to promote knowledge exchange, research, monitoring, education, capacity development and collective decision-making. It supports three kinds of actions to: minimize biodiversity loss through the use of science in the decision-making and policy-making processes; promote environmental sustainability through the network of Biosphere Reserves; and strengthen linkages between cultural and biological diversity. UNESCO works with CONANP in 20 UNESCO sites. (http://www.unescomexico.org/)

Donor	Programs and Activities
German International Cooperation Agency (GTZ)	GTZ has provided assistance through the Program for Environmental Management and Sustainable Use of Natural Resources (2005 – 2009). The program has three components: renewable energy development, waste management and remediation of contaminated sites, and environmental monitoring and information. (http://www.gtz.de/mexico)
Japanese International Cooperation Agency (JICA)	JICA's environmental initiatives are implemented within the framework of the Mexico-Japan Partnership Program. Potential projects (some of which have USAID co-financing) include: Environmental Management Program in Quintana Roo, Social Forest Management in Oaxaca, the Urban Environment Improvement Initiative, Water Quality Program, Wetland Management in Yucatan and Sustainable Rural Development in the Soconusco Region in Chiapas. (http://www.jica.go.jp/mexico/espanol/)
Spanish Agency for International Cooperation (AECI)	The Spanish Government's assistance focuses on governance, public participation, institutional strengthening and environment. Working with SEMARNAT, AECI currently supoprts the following projects: Identification and Development of Projects for the Clean Development Mechanisms; Reconversion and relocation of the artisanal brick-making process in Tequisquiapan, Queretaro; Environment, Poverty and Local Development in the Infiernillo-Sierra Costa Region; development and productive alternatives in the Biosphere Reserve of Tehuacan-Cuicataln. Two additional projects are expected to begin soon: organic chayote management in the Sierra Madre of Chiapas and Improvement in the sustainable management and technological and commercial diversification of pita (Aechmea magdalenae) fiber products. (http://www.aecid.org.mx/)
French Development Agency (AFD)	ADF manages the French Fund for the Global Environment, which supports the French Partnership for Mexico. The Partnership works with local authorities in the integrated management of water resources in the San Pedro River. Other French-supported initiatives focus on supporting farmers in Mexico's southeast region to integrate into regional sustainable agricultural development efforts. (http://www.afd.fr/jahia/Jahia/site/afd/lang/en/pid/1310)
Embassy of Finland	The Government of Finland's Local Development Fund had a budget of 160,000 euros for Mexico in 2008. The Fund supported one conservation project: sustainable use of forests and water in Mexico's rural areas (Chiapas). (http://www.finlandia.org.mx/public/default.aspx?nodeid=32110&contentlan=9&culture=es-ES)
Government of the United Kingdom (G-UK)	The Climate Change and Energy Program aims to contribute to the UK's energy and climate change objectives. It focuses on three areas: strengthening the evidence base to support strategic decision-making; promote the participation of new stakeholders and mobilize political support to promote actions; and stimulate investment through a low-carbon economy. Funding for Mexico in 2008 amounted to $7.8 million. (http://www.fco.gov.uk/en/about-the-fco/what-we-do/funding-programmes/strat-progr-fund/strat-prog-fund-climate)
European Union (EU)	The EU project "Integrated Sustainable Development" (PRODESIS-Chiapas) concluded in 2007. The project developed information systems related with the use of natural resources and the regional ecological plans that have measures and procedures to protect and conserve productive ecosystems, environmental services, and wildlife, as well as to promote restoration. (http://www.prodesis.chiapas.gob.mx/)

Source: Authors, based on information provided by CEDEC to USAID

• USAID Programs in Mexico

USAID/Mexico manages a $16-28 million annual budget for development cooperation in Mexico. USAID's program for 2003 – 2008 supported Mexican development and reform initiatives in the following areas, some of which are ongoing:

Table 17. USAID Programs in Mexico

Program	Activities
Competitiveness and Strengthened Rule of Law	Activities focus on increasing access of local governments to capital markets, government innovation programs, and improved public financial management. USAID also provides technical assistance to support Mexican efforts to put in place more effective civil and criminal justice systems, increased access to justice through court-sponsored mediation centers, and increased professionalism by reforming legal education and professional standards.
Improved Management of Natural Resources and Energy Efficiency	USAID supported efforts to manage and conserve natural resources through the introduction of best practices that improve economic opportunities for areas with exceptional biodiversity. These included promotion of conservation coffee, certified timber products, and sustainable tourism, as well as other practices that protect the environment while increasing local economic benefits. USAID also supported development of community-based natural resource management plans in targeted watersheds, focusing on sustainable forestry and watershed management. Fire management and prevention, pollution reduction, energy efficiency and the promotion of renewable energy are integral components of the Mission's goal to improve natural resource management. Activities are applied in key watersheds in the poorest regions, as well as along the border region with the U.S
Prevention and Control of Infectious Diseases	USAID supports initiatives to improve responsiveness, prevention and control of infectious diseases, particularly HIV/AIDS and tuberculosis. Activities in HIV/AIDS include promoting healthier behavior and positive policies, as well as combating stigma and discrimination associated with the disease. In tuberculosis, USAID cooperates with Mexico's Health Secretariat and its National Tuberculosis Control program to improve planning and modernize technologies for TB detection, diagnosis, and treatment.
Broadening Access to Finance	The goal of USAID/Mexico's Micro and Rural Finance program is to contribute to economic growth, small business creation, and poverty reduction through the deepening of the Mexican financial sector. The program aims to overcome a major obstacle to economic growth—the lack of access to financial services needed by micro and small businesses, small agricultural producers, and the large majority of rural households. The program has a dual focus: (a) strengthening micro-finance institutions, including credit unions, and the services they offer; and (b) improving the enabling environment for rural financial market development. The program focuses on small producers, rural areas, and remittances, allowing for a close link to USAID/Mexico's overall goal of improving rural prosperity by better integrating small rural producers into growing markets.
Higher Education	USAID supports the Training, Internships, Exchanges and Scholarships (TIES) program which establishes partnerships between U.S. and Mexican higher education institutions to address development problems, such as access to microfinance, watershed management, and border health. Currently, there are 60 university partnerships that have led to improved workforce, trade capacity, and competitiveness in Mexico. USAID also funds one and two-year technical training programs in the U.S. for disadvantaged rural, indigenous Mexican teachers and youth respectively. Teachers and youth return to their communities to implement skills gained and lead community projects.

Source: http://www.usaid.gov/locations/latin_america_caribbean/country/mexico/

THREATS TO BIODIVERSITY AND FORESTS

Mexico faces numerous threats to its tropical forests and biodiversity. Direct threats are numerous, and include climate change, land conversion, forest fires, hunting, pollution, invasive species, and overharvesting. Indirect threats (the underlying root causes) include poverty, economic demand, poor governance, weak institutions, poor policies, population growth, and other factors. These underlying causes either create or intensify direct threats to biodiversity and forests. Both direct and indirect threats need to be addressed for threat reduction and mitigation.

The following Threat Analysis and ranking was developed based on information obtained from interviews and available statistics (see Appendix 1). It is a semi-quantitative tool that analyzes the scale and magnitude of an identified threat, the timeframe to onset of impacts, and the feasibility of interventions. Threats are ranked based on severity and scale, as well as the probable outcome of feasible intervention. The most serious threats are identified in the next section.

- ## Direct Threats
  - ### Climate Change (Direct and Indirect Threat)

Large scale loss of Mexico's biodiversity and tropical forest cover may result from the negative impacts of climate change. Climate change affects both marine and terrestrial biodiversity. Depending upon a species' tolerance to changes in temperature and humidity, impacts may be sudden or delayed. The availability of suitable habitat for many species is being reduced; endemics are often at highest risk given their limited ranges. Rising sea levels are eliminating some coastal habitats and higher temperatures are damaging coral reefs. Some species' ranges (e.g. birds) are already changing, but this is only possible if there is habitat available. The rate at which plants can adapt and disperse into new areas lags markedly behind faunal communities. Environmental cues, such as the onset of the rainy season, are changing. This impacts reproductive cycles and can affect the survival of offspring if there is insufficient food available. Higher temperatures and reduced rainfall levels stress forests making them more vulnerable to pest and diseases. Higher numbers of dead trees increases the fuel load and fire risk. Forest fires release enormous amounts of greenhouse gases (GHGs), further contributing to climate change in a vicious cycle.

Mexico is highly prone to droughts, especially in the northern areas. The most severe droughts in Mexico typically coincide with variations in Pacific sea-surface temperatures associated with El Niño. Long-lasting droughts can lead to local extinctions and the loss of biodiversity. Droughts mainly affect agriculture, but they also impact forests, as they weaken and leave them more susceptible to fires and pests. Moreover, the scarcity of water leads to the death of vegetation, including the younger trees, as well as the death or reduction of wild fauna, as their natural drinking sources disappear. Recurrent

droughts may cause significant soil loss, reduction in aquifer levels, reduction in the quality of water and increased salinity in wetlands, promoting desertification.

El Niño / La Niña cycles, which are associated with severe climatic events such as droughts, storms, and floods, are becoming shorter. The impacts are also becoming more severe according to the UNDP. "In 2005 the number of cyclones reported broke the country's historic record. According to the National Meteorological Service, not only were more cyclones reported, but in addition, they were more intense than in previous years and had a greater impact on Mexico" (Manson and Jardel, 2007). Hurricanes have positive and negative effects on forests and biodiversity. They renew the structure and composition of ecosystems and facilitate natural regeneration, allowing an increased diversity of species. However, high-intensity cyclones or high hurricane frequency may affect an ecosystem to the point that it may take centuries to recover. This is because hurricanes cause a considerable loss of soil and vegetation, as well as the destruction of special sites for nesting or feeding animal species. Additionally, the amount of dead matter left in forests after a hurricane turns into fuel, increasing the risk and intensity of fire. An ecosystem weakened by harmful human practices will be more vulnerable to this kind of disaster and its capacity for subsequent recovery (or to benefit from the positive effects) will be diminished.

Mexico's food security and economic growth are likely to be negatively impacted by climate change. Potential reductions in the number of pollinators, seed dispersers, and insectivores will reduce agricultural productivity. Coral reef bleaching, resulting in the die-off of important fish habitat, may already be having a negative impact on fisheries production. Reduced productivity in the agricultural and fisheries sectors will most likely lead to increased poverty and reductions in food security.

- ## Land Conversion

Land conversion completely eliminates habitats and is a direct major threat to Mexico's fauna and flora. The speed, severity, and (frequent) irreversibility of land conversion make this threat one of the highest priorities for terrestrial habitats. Sedimentation impacts aquatic habitats, and is particularly troublesome in coastal areas with high levels of mangrove conversion. The productivity of coral reefs and seagrass beds is reduced as a result of sedimentation.

Typical results of forest conversion include forest fragmentation, the loss of biological corridors, and the creation of biological islands. Isolated individuals/species groups are at higher risk of extinction, as they cannot migrate in search of food, mates, or breeding grounds. Due to easier access, lowland forests are generally at greater risk of conversion than mountain forests. Conversion of forests also releases GHGs that contribute to climate change. GHG emissions from deforestation are estimated to account for 30% of total GHGs in Mexico. Land and forests are typically converted for additional pasture for cattle, agricultural expansion, creation of timber plantations, or urban expansion/infrastructure building, as discussed below.

- ## Cattle breeding

The area used to breed cattle has shifted from about 38 million ha in 1930 to over 90 million in 1983 and to 110 million ha in 2007, becoming the most widespread kind of land use in the country (SAGARPA, 2007). In the last 20 years, although meat products entering Mexico from the United States have given Mexican cattle breeders much competition, cattle breeding has continued to expand because

it provides both profitability and family subsistence. Rangelands, including pastures, shrublands, dry woodlands and forests, now occupy 57% of Mexico's territory.

Cattle breeding in Mexico's forest lands is ongoing and on the rise. In the states of Chiapas, Campeche, Quintana Roo, Oaxaca, Guerrero and Michoacan, the clearing of regular and low rain forests to make way for pasturelands continues for several reasons, including: the difficulties that owners face in producing and marketing timber, as well as government incentives for cattle breeding and the certainty which cattle land use affords in terms of ownership.[8] For example, land titling by the Government (through PROCEDE) did not provide titles for forested lands. This motivated landowner to deforest their land in order to demonstrate ownership and obtain land titles.

• Agriculture and Fruiticulture

Land use change from forests to agricultural and fruiticulture has also been a significant threat to forests. According to SEMARNAT, "areas dedicated to agriculture and pasturelands increased by almost 5 million hectares each during the 26 years from 1976 to 2002". This represents a 20% increase in agriculture and a 35% increase in the case of summer pastures (SEMARNAT, 2007).

According to data by SAGARPA, agriculture in Mexico is carried out in four million production units occupying approximately 21 million hectares (SAGARPA, 2007). From 2001 to 2006, agricultural production increased on average 19% when compared to the previous six-year administration, and 36% when compared with 1989-1994. Crops with the highest growth were fodders, vegetables and fruits. Although the SAGARPA report shows that the general increase in agricultural production is the result of increased productivity and not an increase in the area planted, this is not the case for "fruit trees" in particular, which "are recording a rising trend" in terms of area (SAGARPA, 2007).

Numerous examples illustrate the problem. In Michoacan, 11 avocado-producing municipalities were documented to have recently lost 30% of the forest area (Barsimantov and Navia, 2007). Other cases include agave in Jalisco and Oaxaca, the African palm crop in Chiapas, and the expansion in the area dedicated to mango, papaya, lime and nopal crops around the country. In the case of African Palm, the Chiapas state government declared that plantations could cover a potential area of 100,000 ha.[9] As of 2007, only 5,000 ha were planted, but the area was expected to increase to 29,000 by the end of 2008. The increase of African Palm areas does not necessarily imply a loss of forest lands, but does represent a significant threat taking in account the cattle breeding experience in the tropics.

• Commercial Timber Plantations

Commercial forest plantations are an economic alternative for rural areas, especially where traditional crops are not profitable. In addition, they provide more environmental services than agricultural lands if they are managed carefully. However, if forest lands are substituted to grow commercial plantations, they represent a threat to forest conservation. Furthermore, if cheaper timber products from

[8] This happens because PROCEDE program has recognized the individual possession of community lands when the peasants demonstrate they are developing "productive activities", as agriculture or cattle breeding.
[9] *El Financiero,* "Palma africana, opción para agroeconomía de Chiapas," April 27, 2008. http://www.elfinanciero.com.mx/ElFinanciero/Portal/cfpages/contentmgr.cfm?docId=117560&docTipo=1&orderby=docid&sortby=ASC

plantations compete with natural forest products; this can discourage the sustainable management of natural forests, and motivate the abandonment and neglect of forest lands.

Official documents state that timber plantations are part of a strategy for the defense of natural forests, because plantations provide timber for markets, reducing pressure on natural forests (Presidencia de la República, 2007). However, several organizations such as Forest Trends and CCMSS, as well as researchers and forest managers, have questioned this approach because it is likely that the timber-yielding production of plantations will lead to a change from forest land use to other uses.[10] This is because the large supply and low prices of plantation timber-yielding production displaces the production of natural forests from the market. The owners and managers of natural forest lands will therefore be forced to look for land use alternatives in cattle breeding, biofuels production or else in commercial plantations. However, timber plantations do not offer the same ecosystem services that forests provide, and do not offer the same biodiversity characteristics because they can be mono-specific. Moreover, they do not allow natural regeneration or the installation of several flora and fauna species, and could even be a risk for biodiversity if cultivated exotic species propagate in natural ecosystems.

Mexico's federal government is committed to promoting plantations. CONAFOR states that "In Mexico, the area of plantations established with grants from the Federal Government up to December 2007 was about 90 thousand ha and the volumes they provide are still low because of the immaturity of most of these projects – most of the areas were established in 2001 or later-, hence practically all of the domestic timber production continues to be supplied by low-management natural forests. It is estimated that by 2025, plantations will contribute between 60 and 70% of the country's wood production" (CONAFOR, 2008). If this happens, forest owners will have to compete against plantation products.

- ## Urban/ Infrastructure

The composition, structure, and disturbance dynamics of native ecosystems throughout Mexico have been drastically altered due to urban expansion and infrastructure development. Coastal mangrove areas are being converted for large scale tourism developments. In addition to conversion of lands, roads and walls cut through ecosystems. Highly fragmented landscapes have greater "edges", and suffer from greater "edge effects". There is lower humidity, higher temperature, and greater wind impacts on edges. Species composition along edges is often significantly different from the interior. Continuing fragmentation of available habitat is particularly threatening for the more than 300 neotropical migratory bird species dependent on an integrated network of stopover habitat sites (Thomas and Finch, 1995), and a host of other migratory vertebrate and invertebrate species such as the Monarch butterfly (Danaus plexippus).

- ## Forest Fires

Forest fires are a major cause of deterioration and degradation of the country's forest territory. The main causes of forest fires include uncontrolled fires resulting from slash and burn agricultural practices,

[10] See, for example: http://forest-trends.org/resources/presentations.htm

as well as abandoned or unattended bonfires (Figure 4). Additionally, droughts and excessive combustible material not removed from forests help fires spread.

Figure 4. Main Causes of Forest Fires in Mexico

According to data from yearly reports by CONAFOR, in the last 10 years fires have affected an average 224,000 ha per year, including forested areas, shrubs, bushes and pastureland. Of this total figure, only 17% refers to fires in areas with forest (Table 18).

Table 18. Area Affected by Fires

Year	Pasturelands		Forested		Shrubs and Bushes		Total	
	'000 ha	%	'000 ha	%	'000 ha	%	'000 ha	%
1998	352.34	41.46	198.49	23.36	298.90	35.18	849.63	100.00
1999	87.84	38.02	41.36	17.90	101.86	44.08	231.06	100.00
2000	101.15	42.88	40.48	17.16	94.29	39.97	235.92	100.00
2001	64.95	47.10	18.81	13.64	54.14	39.26	137.91	100.00
2002	87.67	44.16	31.64	15.94	79.23	39.91	198.54	100.00
2003	103.90	32.22	88.26	27.37	130.29	40.41	322.45	100.00
2004	37.95	46.66	10.52	12-93	32.86	40.41	81.32	100.00
2005	125.54	45.47	32.70	11.84	117.85	42.68	276.09	100.00
2006	85.18	34.93	42.12	17.27	116.58	47.80	243.88	100.00
2007	87.18	40.36	15.15	10.69	69.33	48.94	141.66	100.00

Source: 2007 weekly results report of forest fires, CONAFOR

In the last decade, the years with the most fires and the greatest damaged area were 1998, 2003 and 2005. However, 1998 was the year in which the forest fire season hit hardest, having affected an area of over 800,000 ha of vegetation. From 2005-2007, the states with the largest area affected by forest fires were Baja California, Quintana Roo, Oaxaca and Jalisco, which are the states with the largest forest areas (Table 19).

Table 19. States Most Severely Affected by Fires (Affected Ha)

State	2005	2006	2007	Total
Baja California	38,959	13,738	29,685	82,380
Quintana Roo	5,761	53,619	757	60,135
Oaxaca	30,938	13,096	16,032	60,066

Jalisco	28,407	15,810	14,963	59,480
Chiapas	23,508	10,485	12,894	46,885
Michoacan	17,443	13,175	11,628	42,246
Chihuahua	4,673	18,505	10,561	33,736
Guerrero	18,004	3,034	12,621	33,659

Source: National Forestry Information System with data CONAFOR September, 2006

It should be noted that Mexico has some forests, such as pine, that are fire-adapted. Fire is often used as a management tool in these forests to control fuel load. High fuel loads lead to high temperature fires that may do severe damage. Poorly managed and degraded forests typically have excessive fuel loads resulting from twigs, limbs, and bark debris left behind during extraction and large amounts of ground cover, such as ferns, that grow in forest gaps. The debris and ground cover dry out quickly during droughts and make it easier for fires to spread. In contrast, tropical forests are not fire-adapted and may be permanently altered by fires. Primary tropical forests have higher humidity levels and lower amounts of ground cover that make them more resistant to fire invasion.

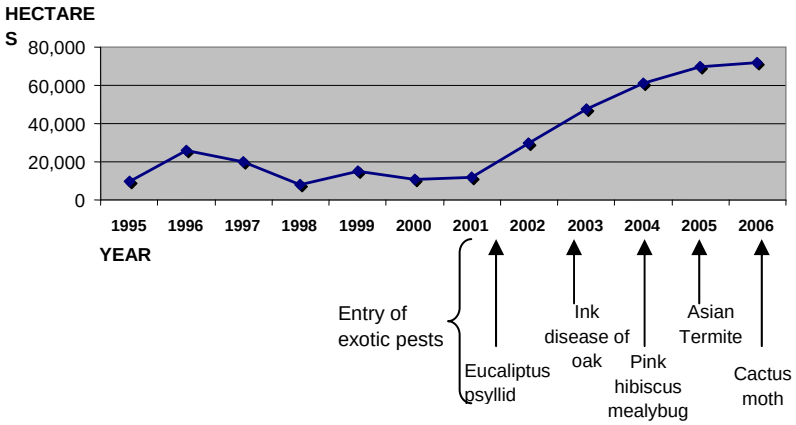
- ## Invasive Species and Diseases

Invasive (also called introduced) species may outcompete native species. This can result in local extinctions and alter ecosystem process, thus reducing biodiversity. Although Mexico recognizes the threats from invasive species, there are no specific laws in place to respond directly to this risk (Koleff, 2007). Invasive species enter ecosystems from an enormous number of pathways, ranging from fishing bait, packaging and transport, transmission by grazing animals, ballast waters and marine platforms and direct releases. Although the actual number of exotic and invasive species resident in Mexico is unknown, a list of 3,000 invasive weed plants has been recorded (TNC, 2007), and CONABIO has proposed the development of a collaborative data base among national and international agencies and groups to catalog species and identify risks (Koleff, 2007).

According to CONAFOR "Mexico has over 200 species of insects and pathogens registered that can cause damage to trees, resulting in significant economic, ecological and social repercussions. It is estimated … that 2 million hectares are at risk of attack by 16 different species of insects or native diseases (Zenteno, 2007). The causes of pests and diseases in forests include: aggressive species arriving from other countries in imported forest products, such as Christmas trees; increased area and forest species used in commercial plantations; weakening of forests through neglect, since an unmanaged forest lacks the spacing, cleaning and reforestation needed to prevent the spread of damaging species (Billings *et al.*, 1996); and storms, fires or droughts that weaken the strength and vitality of the ecosystems.

Pests which attack the greatest area of forests in this country are bark beetles, followed by mistletoes, then defoliators and borers. However, in recent years the arrival of "exotic pests", such as the Asian termite, the pink hibiscus mealy bug and cactus moths have been significant. Between 2004-2006 an average of 62,800 ha per year were affected by this threat (Figure 5).

Figure 5. Surface Affected by Pests and Diseases



Source: CONAFOR (2008)

• Over-harvesting

Over-harvesting of plants and animals puts populations at risk of extinction if the rate of extraction exceeds natural reproduction rates. Over-exploitation of fish from a poorly controlled fishing industry is a particularly important challenge in this region. Species at risk of local extinction in the Gulf of California include the cabrilla, black and white seabass, Gulf grouper, yellowtail, and dog snapper. Sea turtles, hammerhead sharks, and giant manta rays are now virtually absent in this region. With higher rates of fishing mortality and the escalation of gear types to gill nets, trawls and longlines, there has been a fairly rapid reduction in total standing stocks, switches in species dominance and the loss of older age classes of larger fish. The apex predators of the Gulf of California also appear to have declined to very low levels. The stocks of highly migratory species (marlin, sailfish, and tunas) are also in decline, which directly affects the local commercial sport fishery. This reduction is likely due to by-catch mortality. In some locations fish catches have almost entirely disappeared in recent years.

It is possible that stock reserves in the eastern tropical Pacific and Caribbean are sufficient to restore the abundance of recently depleted species. In addition, several deep submarine trenches cause a strong upwelling of nutrients, particularly in the southern reach of the Gulf of California, that can contribute to resilience. However, the continuing over-harvesting of large pelagic predators could trigger a broad expansion of jellyfishes, squid and small pelagic fishes which will in turn disrupt the long-term productivity of this important area.

The collection of shrubs and small trees in desert, semi-desert and woodland ecosystems continues to represent a primary source of fuel for many area residents. However, local residents and resource managers have few data to assess the available supply or demand for these resources, or to guide management of these very limited resources. Shrub and tree regeneration and productivity in these fragile ecosystems may be declining significantly.

The illegal capture of wildlife drastically reduces limited and isolated populations and affects the long term viability of these species. For example, endangered bird species such as the endangered Thick-

billed Parrot (*Rhynchopsitta pachyrhyncha)*, Military Macaw (*Ara militaris*), Lilac-crowned Parrots (*Amazona finschi*), and Green Parakeets (*Aratinga holochlora)* are routinely captured as fledglings and sold in local markets.

Grazing pressures have increased in recent years and exceeds the carrying capacity of fragile dryland ecosystems. Overgrazing has degraded the soil and water retention capacity of upland watersheds, and particularly altered plant diversity and regeneration in riparian areas. Grazed areas are often poorly managed, particularly in terms of stocking densities and rotation of lands, and state and federal agencies lack the staff and resources to improve practices. As a result native grass species are in decline and opportunistic shrub species increasingly dominate. Many of these opportunistic species are also invasive, extremely difficult to eradicate and of limited use for livestock or other livelihood needs. In some areas overgrazing has advanced to eliminate almost all ground cover altogether.

- ## Freshwater and Aquifer Depletion / Contamination

Freshwater habitats, such as rivers, streams, and desert pools are being degraded or drying up, leading to a reduction in biodiversity. Climate change, deforestation, dams and the diversion of the flow of water for use in agriculture, industry, and by households, are all contributing to the loss of water bodies. Extraction rates from aquifers are exceeding the rate of replenishment through rainfall. This can lead to desertification, ground subsidence, and saltwater intrusion that contaminate aquifers. Over-pumping of groundwater for agriculture and urban uses is a particular problem in several important Chihuahua watersheds, including the San Pedro, Río Grande, Río Conchos, Río Extorax, and Río Aguanaval.

Pollution, from both non-point (e.g. agricultural run-off and acid rain) and point (e.g. industry) sources are contaminating water bodies and wetlands. Waste water management is variable across Mexico; not all waste is disposed of properly.

- ## Poverty and other Socio-Economic factors

Poverty and economic forces, such as market demand, the lack of viable economic alternatives, low competitiveness and lack of access to financial resources, especially for the rural poor, have a negative impact on biodiversity and tropical forest cover.

- ## Poverty

Poverty and environmental degradation have multiple linkages. Poverty-stricken populations often extract resources more rapidly because those resources have greater value if they are used to satisfy present needs than if saved for future consumption. Also, poor populations face greater constrains in accessing information or technologies that would help them to optimize the use of natural resources, as evidenced by traditional agricultural practices in Mexico. Environmental degradation can also exacerbate poverty, particularly because poor populations are more vulnerable to events such as natural disasters, largely because they are willing to take greater risks. For example, poor populations tend to establish their homes in disaster-prone areas, including riverbeds. Indoor air pollution caused by the use of biomass as fuel for cooking and heating has severe health effects on vulnerable groups, particularly poor women and children, which tend to be more exposed to smoke. The effects are more severe than for non-poor groups, because the poor tend to have overall worse health conditions and have less resources to cope with disease.

• Market Demand

Increases in market demand can lead to over-harvesting of timber, endangered agave, and other natural resources, as well as forest conversion to produce agricultural crops, biofuels (e.g. oil palm, sugarcane), and for cattle pasture. There is currently little market pressure, from either government or citizens, for certified sustainably harvested products. In addition, current regulations limit labeling of products, making it difficult to raise awareness among final consumers. Market demand for some crops, including palm oil, has been reduced by the current financial crisis (in 2008 and 2009), but this will probably be temporary.

• Lack of Economic Alternatives

Community members in some states such as Chiapas have limited economic opportunities due to low levels of education, and the lack of large scale industry and infrastructure (e.g. electrical power) that would support economic growth. Many are limited to agriculture, fisheries, logging, and non-timber forest product extraction. Food prices have risen sharply over the past year, and this is a major hardship for both the urban poor, as well as the indigenous communities. The combination of high food prices and the lack of economic alternatives can lead to illegal hunting and logging, conversion of forest for agriculture, and over-harvesting in order to meet basic human needs.

• Lack of Competitiveness

Lack of profitability and inability to compete in open markets are leading private owners of forest lands to pursue land uses that provide better earnings than sustainable forestry, such as cattle breeding or growing fruit crops. Producers use inefficient technologies and methods, resulting in greater waste and more effort. Producers also face numerous external obstacles to competitiveness, such as the difficulties faced in filing applications to obtain authorization for their forestry management plan, the poor condition of roads and highways, lack of railway transport, and obsolescent infrastructure. There are numerous barriers to interacting with domestic and international markets, including lack of information regarding taxes, commercial procedures, consumer safety, and quality standards, resulting in difficulty in delivering products on time and in high volume. These factors cumulatively result in higher production costs and prevent producers from competing in open markets with imported products, in many cases subsidized or originating from forestry plantations.

• Lack of Financial Resources

Access to financial resources, such as loans, is limiting *ejidos* and communities from making the necessary investments for sustainable management of natural resources. This is negatively impacting tropical forests and biodiversity through continuation of poor management practices. Funds are required to conduct technical surveys required for the forestry management plan, installation of infrastructure to process raw materials, analyses of sustainable yields, etc. Additionally, funds are required to develop Payments for Environmental Services or UMAs.

• Asymmetric Information

The different stakeholders involved in the preservation and exploitation of forest resources have various levels of information with respect to markets, regulations and available public and private assistance. Consequently, a large number of small owners, *ejidos* and communities owning forests have limited possibilities of integrating themselves into markets for environmental goods and services. Additionally, a lack of information creates a disadvantage when they try to compete in domestic and international markets. Finally, this situation also prevents the creation of innovative businesses that can properly manage resources to engage in sustainable production.

• Organizational and Institutional Deficiencies of Producer Organizations

One of the most important obstacles against the development of strong forestry enterprises that ensure sustainable forest management has been the difficulty in establishing transparent and accountable procedures. In some forest regions community enterprises often shut down due to organizational deficiencies or poor financial management. *Ejidos* and communities that have been able to establish successful institutions, and in turn have received support, have been able to establish forestry enterprises which both protect natural resources and bring economic benefits to local stakeholders.

• Migration

Migration from rural areas to the city and to the United States is a phenomenon that has been on the rise in the past 40 years. "The yearly net flow (difference between migration and immigration) has multiplied -in absolute terms- more than threefold in the last three and a half decades, shifting from a yearly average of 29 thousand persons in the sixties to over 300 thousand migrants per year in the nineties, and nearly 400 thousand in the first four years of this century" (CONAPO, 2008). Migration has caused the abandonment of forests. An important reason for migration has been the lack of opportunities of employment and development in the country and the economic, social, legal or other impossibilities to develop a profitable management of natural resources. Thus, forests have remained unprotected, without management and vulnerable to plagues, fires, clandestine logging and illegal extraction of species. In the case of forests that are abandoned after having been perturbed, this vulnerability is even greater. The presence of an organized population around the management and preservation of ecosystems is fundamental to avoid their loss.

• Illegal Logging

Illegal logging has negative consequences both for ecosystems and society. This kind of exploitation is carried out without a defined plan or techniques that would minimize the impacts of forest exploitation on the environment and protect the sites, species and special ecosystems. Moreover, competition from illegal timber, which is cheaper than legal timber, removes legal wood from the market and reduces prices for legitimate businesses.

In 2006 the cost of the impact on formal producers was estimated at 3.6 billion pesos. In addition, clandestine activities rob the federal government of over half a billion pesos per year in revenue that should be obtained through Value Added Tax on the first transformation of timber (CCMSS, 2007). Finally, illegal logging undermines the rule of law and contributes to ungovernability and violence in the countryside.

There are different estimates as to the volumes of timber extracted illegally each year: the *2025 Programa Estratégico Forestal* (PEF, Strategic Forestry Program) estimated extraction to be 13 million cubic meters per annum; the 2007-2012 Environment and Natural Resources Sectoral Program calculates a volume of 3 to 5 million raw m^3, and the Mexican Civil Council for Sustainable Forestry estimates that the volume of wood illegally extracted corresponds to half of the volume legally produced in Mexico –which from 1995 to 2004 registered a yearly average of 7.6 million raw m^3-, i.e., some 3.8 million raw m^3 per year (CONAFOR, 2008).

There are 32 priority critical forest regions that were defined in 2006 by the Federal Environmental Protection Agency (PROFEPA), in which more than 60% of the clandestine logging is carried out. Eleven of these regions are located in Protected Natural Areas. Among them are: the Monarch Butterfly Reserve, the Zempoala Lagoons, Izta-Popo, Los Chimalapas, El Ocote and Montes Azules. The Average and Normal Attention categories are formed by areas such as Montaña, Sierra del Ajusco, Región Productora de Carbón Vegetal, La Malinche, Cofre de Perote, Acaxochitlán, Villa de Cos, Pinos and Punto Put.

Although the government is investing capital and effort to address illegal logging, there have been few results. From 2001 to 2007, PROFEPA only secured about 0.13% of the calculated total of timber illegally extracted in the country (CCMSS, 2007). This is due in part to the fact that the "zero tolerance" policy, which entails raids to detain illegal loggers, does not attack the main causes of illegal logging, which include: the existence of excessive, expensive and complicated red tape to carry on legal forestry activities;[11] relatively low levels of support for development of sustainable industry; unchecked expansion of the illegal market of wood, and lack of a useful system to certify and/or verify the legal origin of the timber.

- ## Mining

Small scale mining, typically less than 10 ha in area, can have significant negative impacts on biodiversity and forest cover. The monitoring and management of small-scale mining operations continues to be a significant challenge for government in Mexico. Small-scale mining may account for more than 50% of the gold and gemstone production in Mexico, although the location, production practices, output and direct and indirect impacts from these mines on downstream water supplies and riparian habitat is poorly documented. Chemicals (such as cyanide) and heavy metals (such as mercury) may be used in gold processing, with serious impacts on both human and ecosystem health. Small-scale operators lack access to training and resources that could significantly improve the environmental sustainability of mining operations.

[11] For examples, see the section of "Indirect threats: Public policies"

Indirect Threats

Counterproductive Policies

Policies may intentionally or unintentionally have negative consequences for tropical forests and biodiversity. Ambiguous or conflicting policies lead to confusion over authority. Policy problems can lead to land conversion and wide scale pollution, resulting in loss of biodiversity and forest cover.

Public Policies that Indirectly Encourage Land Use Change

During the 1960s and 1970s the government encouraged a series of actions to expand the agricultural frontier, including colonization and clearing programs. These actions had an enormous impact on the country's forest areas and more than 10 million ha of forests were converted. Although those policies stopped in the eighties, remaining programs encourage animal husbandry and farming production without providing incentives for engaging in practices that preserve forests and biodiversity. Government subsidies continue to make it economically rational for farmers to destroy forests (Table 20). Some examples of such programs are:

- PRODEPLAN: Subsidizes commercial forestry plantations, which are expected to make natural forests less competitive in the future. The program's 2008 budget was more than $80 million.
- PROGAN: Provides an incentive to cattle breeders through a payment per "head of cattle" regardless of the land type or technology used.
- Various state governments programs provide subsidies to promote agriculture and cattle breeding. In general, there are no conditions attached or incentives included to protect tropical forests and biodiversity. Examples include programs for avocado in Michoacán, agave in Oaxaca and Jalisco, and African palm and cattle breeding in Chiapas.

Table 20. Public Programs for Farming and Forestry Promotion

	Program	Millions of pesos
Farming Grants	PROCAMPO	16,678
	Alianza para el Campo	12,943
	PRO-GAN	4,200
Forestry Grants	PRODEFOR	656
	Plantations	884
	Reforestation	1,780
	Environmental Services	738

Source: SHCP / Federal Expenditures Budget. 2008 Fiscal Year

• Bureaucratization in the Forestry Sector

Forest land owners wishing to legally profit from forestry activities face a series of excessive, expensive and often confusing application procedures required by SEMARNAT. To start managing a forest, it is necessary to pay for a permit (2,000 – 6,000 pesos), a management plan (145,000 - 150,000 pesos), and other transaction costs. It is also necessary to employ a provider of technical services, compile a series of documents and comply with other requisites depending on the type of forest. Besides, the times and deadlines to deliver documents and to receive responses are not easy to follow (CCSMSS, 2008). These procedures make legal logging difficult and provide incentives for engaging in clandestine logging or illegal extraction of forest products. For instance, excessive procedures have influenced the decrease in the number of authorized management plans from 5,567 in 2001 to 1,711 in 2005 (CCSMSS, 2008).

• Land Ownership

In the past 70 years 30,000 *ejidos* and communities have been granted land titles. This has been a complicated process due to numerous problems involving area demarcation and litigation. In the last 20 years a large number of legal disputes have been resolved, mainly in urban and farming areas; however, litigations over demarcation continue to take place in hundreds of communities and *ejidos*. Forest areas under litigation are not included in management plans and are commonly looted by illegal fellers.

In 1994, PROCEDE[12] (Program for Certification of *Ejido* Rights and Granting Title over Plots), initiated its operation in order to deliver to *ejidos* formal titles where each of the *ejidatarios* received a formal document that recognized the property of their parcel. These actions have stimulated, in many *ejidos*, the decision to irreversibly fragment collective land and develop individual productive strategies instead of a collective strategy. Fragmentation of collective land has important implications because sustainable forest management typically must be carried out in relatively large areas to be profitable. This phenomenon remains largely undocumented.

• Population Growth

Mexico's population growth is still higher than the replacement rate. This leads to greater demands for natural resources, and may result in over-harvesting, increased land conversion and pollution. It should be noted that Mexico's rate of population growth has declined markedly over the past several decades. There had been significant levels of out-migration from rural areas in the past; however, the current economic crisis (in 2008 and 2009) is resulting in a large number of people returning due to lack of work.

• Poor Governance

Mexico has advanced significantly in strengthening transparency and accountability mechanisms, particularly at the Federal level. However, these mechanisms still face challenges, as illustrated by the controversy surrounding the ProArbol program implemented by CONAFOR that started in the last

[12] http://www.pa.gob.mx/publica/pa070113.htm

quarter of 2008. According to Greenpeace, only 7.6% of trees planted as part of the reforestation efforts supported by ProArbol will survive due to poor planning and lack of continual care for seedlings after planting, which raises questions about the program's efficiency.[13] *El Universal*, one of Mexico's prominent newspapers, has reported about widespread corruption in ProArbol's implementation.[14] Some politicians have suggested the need to cancel ProArbol, while opinion leaders and authorities defend the program and argue that it is part of the first relatively stable forestry policy in Mexico.[15] What is clear from this debate is that public information regarding the results of public programs is insufficient. Moreover, it is necessary to strengthen mechanisms that engage stakeholders and civil society in open discussions on Mexico's environmental and natural resources management policies.

[13] SEMARNAT, "Los resultados de ProÁrbol, estrictamente apegados a la verdad," *Comunicado de prensa número 193/08*. October 14, 2008. http://www.semarnat.gob.mx/saladeprensa/boletindeprensa/Pages/Bol%202008%20193.aspx
[14] *El Universal,* "Fracasa ProÁrbol; acusan corrupción," January 14, 2009. http://www.eluniversal.com.mx/primera/32325.html
[15] Julia Carabaias, "ProÁrbol cuestionado," January 22, 2009. http://www.reforma.com/editoriales/nacional/481/960776/

ACTIONS NEEDED TO CONSERVE BIODIVERSITY AND TROPICAL FORESTS

This section begins with a brief discussion on the potential linkages between Mexico's biodiversity and forests and USAID's program in the country. It then discusses the areas where USAID should focus its efforts.

• Linkages of USAID Activities with Forests and Biodiversity

USAID's program in Mexico has the potential to positively impact the country's forests and biodiversity. Nevertheless, the effects of some programs could be associated with increased pressures on the environment and natural ecosystems, if they are not carefully planned (Table 21). USAID's main activities include supporting policy-making, capacity building, and knowledge sharing. The environmental effects of these types of activities are more difficult to predict and monitor than those of investment projects. The recommended approach under these circumstances is to mainstream sustainability considerations in all of USAID's program.

Table 21. Linkages of USAID Activities with Forests and Biodiversity

Program	Activities
Competitiveness and Strengthened Rule of Law	Strengthening the rule of law could have a positive environmental effect, particularly as lack of enforcement of environmental regulations and widespread illegal activities are among the most significant threats to forests and biodiversity. Enhancing competitiveness could also have positive environmental effects, particularly if firms become more competitive by adopting practices or technologies that increase efficiency in the use of energy, water, and other inputs. However, competitiveness is promoted to stimulate economic growth, which in the case of Mexico, has been closely associated with pollution and environmental degradation.
Improved Management of Natural Resources and Energy Efficiency	This activity clearly aims to address threats to Mexico's biodiversity and forests.
Prevention and Control of Infectious Diseases	This activity is not anticipated to have significant effects on Mexico's forests and biodiversity.

Program	Activities
Broadening Access to Finance	Broadening access to finance can have positive effects on biodiversity and forests, particularly if it enables rural communities to access the funding needed to develop economic activities that promote protection and sustainable use of biodiversity and forests. Rural communities that benefit from access to finance may reduce their dependence on natural resources, for instance, by switching from the use of fuel wood to other energy sources. However, finance can also stimulate economic activities that are associated with negative effects, such as extensive agriculture and animal husbandry.
Higher Education	Higher education can be associated with positive effects on forests and biodiversity, particularly if it contributes to enhance the local capacity to sustainably manage natural resources.

Source: Authors

• Recommendations to Guide USAID's Program in Mexico

The following recommendations identify the areas where USAID can be more effective in supporting Mexican efforts to conserve biodiversity and tropical forests. The recommendations focus on areas where governmental and NGO efforts are missing or need to be scaled up, and where USAID can add value given its previous experiences and available technical, financial and human resources.

• Strengthen the Capacity of Government Agencies for Environmental Management

The Government of Mexico has developed an institutional framework that includes a diversified set of instruments and programs to protect biodiversity and forest. Still, important challenges remain. USAID can support Mexico's efforts to address threats to biodiversity by providing assistance in three main areas, as discussed below.

• Strengthening the institutional capacity of the environment sector

Natural protected areas and UMAs are Mexico's main instruments for conservation and sustainable use of biodiversity. SEMARNAT anticipates that other instruments, including payment for environmental services, will expand in the future. USAID can assist in strengthening all of these instruments. Since its creation in 2000, CONANP has strengthened its capacities to manage natural protected areas. However, USAID could play a capital role in helping CONANP develop new policies or programs that generate additional revenue for conservation activities and mechanisms to diversify the income sources of local communities.

These activities would help reduce the pressures that natural protected areas face, such as deforestation and invasion from illegal settlers. Examples of these activities include ecotourism and selling of environmental services in private markets. USAID is well positioned and has global resources and experience to support the adoption of strategies, policies, and methodologies to develop these activities. In addition, USAID can employ technical resources to enhance CONANP's capacity to manage

protected areas that have received relatively less attention or face severe threats, including marine protected areas and wetlands that have been registered under the Ramsar Convention.

In the case of UMAS, the key challenges that USAID can help address include strengthening SEMARNAT's capacity to review requests for the establishment of UMAs and PROFEPA's ability to oversee the conditions established in the approval process. Another important issue is creating incentives for the expansion of UMAs in Southern Mexico, where a significant portion of the country's biodiversity is found, but UMAs cover only a minor share of the territory.

CONAFOR's efforts to promote a program of payment for environmental services that provides economic incentives for local communities to conserve ecosystems are commendable. However, these programs are contingent on continued government funding. USAID adds value by facilitating the development of local market mechanisms for local services (such as hydrological regulation) and by connecting Mexican stakeholders with buyers of global environmental services (such as carbon uptake).

Forest fires and invasive species are a severe threat to forests. The US Government has supported Mexican authorities in the past to address these issues. USAID is well positioned to facilitate further cooperation, including new efforts to strengthen the institutional framework in these areas. For example, this document identified an important gap in the treatment of invasive species under the Mexican environmental legal framework that could potentially be filled with USAID's assistance.

Illegal markets should be one of the priority areas for the USAID forest program. As described previously, wood from illegal origin equals up to 71% of the legal wood market. Government control strategies, including documentation for timber transportation in the so called *papel seguridad*[16] (security paper), have not been effective. USAID could help pioneer more innovative mechanisms, such as the introduction of a national certification of origin system for legal wood. The system would make it obligatory for timber-yards and industries that process wood to enroll into a certification process to prove their stocks actually come from legal wood[17].

Regional environmental plans (*ordenamientos ecológicos del territorio*) have significant potential to promote sustainable development at multiple scales. However, current experience raises questions about the instrument's effectiveness in a country where environmental enforcement is weak and political and economic interest often triumph over conservation initiatives. USAID's assistance could focus on identifying obstacles to regional environmental plan development and enforcement, as well as piloting new approaches at local and community scales that can later be scaled up.

[16] "Papel seguridad" is the type of paper that is used to print the timber transportation permits. This paper has some security features such as water marks and codes, in order to prevent falsification.

[17] The Mexican Civil Council for Sustainable Forest Cultivation has prepared a proposed plan that includes evaluation criteria which could be applied to that system as well as to the evaluation procedures by third-party certifiers.

- ## Streamlining regulations and adopting best practices for sustainable natural resource management

Regulating natural resource management is a challenge in Mexico, where authorities face tradeoffs between conservation objectives and the promotion of productive activities. Existing evidence suggests that the regulatory framework is a significant burden for the development of forestry activities, which creates incentives for illegal timber extraction and land use change. USAID can help Mexican efforts to address this issue by supporting robust evaluation and monitoring mechanisms for existing programs and regulations. USAID can also promote informed dialogue amongst authorities, producers, NGOs, academic centers and other stakeholders with the aim of continuously improving policies and programs in the environmental sector and identifying areas where Governmental interventions would be most effective.

Forest plantations could become a threat for natural ecosystems, particularly if they do not incorporate practices to ensure minimization of negative environmental, social and economic impacts. USAID can play an important role in facilitating the adoption of "best practices" and sustainable procedures in plantation management. USAID's assistance could include assessing the effects of existing subsidies for plantations that may create incentives to land use change, as well as promoting the use of principles and criteria developed by the Forest Stewardship Council (FSC) or other relevant bodies. Additionally, USAID's assistance could help mainstream sustainability principles and criteria in regulations and programs that foster commercial plantations.

- ## Facilitating coordination between the environmental sector and other sectors

Many threats to forests and biodiversity stem from activities that are promoted by governmental agencies. SEMARNAT cannot and should not spend its limited resources fighting environmental degradation stimulated by public policies and programs. The Federal Government's Cross-Sectoral Agendas have aimed to address this situation, but tremendous challenges remain as evidenced by continued government funding to environmentally-damaging agricultural and livestock practices.

Traditional agricultural and livestock practices remain the most significant threat to Mexico's forest and biodiversity. A clear gap that USAID can help to fill is assessing experiences undertaken over the last few years to incorporate sustainability criteria into agricultural and animal husbandry practices. Such an assessment should include an evaluation of existing technical capacities, cultural attitudes, and economic incentives to adopt new practices that do not threaten forests and biodiversity. The assessment could become the basis for policy and program modifications at federal and state levels.

Marine biodiversity has received considerable less attention than terrestrial biodiversity in Mexico. The Government of Mexico recognizes the importance of developing an integrated approach to coastal management, including the adoption of sustainability criteria for activities that currently affect ecosystems such as fisheries and tourism. USAID can provide technical resources to help the

Government of Mexico identify its policy options to improve coastal management and build consensus to implement the most suitable alternatives.

The significance of climate change as a threat to forests and biodiversity is expected to increase in the short, medium, and long terms. Mexico is highly vulnerable to climate change and in response has developed a National Climate Change Strategy that addresses both mitigation and adaptation. USAID's role can be that of supporting translate the strategy into concrete actions, particularly in areas such as enhancing the knowledge base about the anticipated effects of climate change and providing technical assistance to help rural communities adapt to changing climatic conditions. USAID should focus primarily on actions that have environmental benefits in the short term and that would also help to adapt to climate change. Such actions might include providing assistance to improve agricultural practices that reduce stress on water resources or soil degradation in the short term and would enable Mexico to respond more effectively to the effects of climate change. Similarly, support to preserve ecosystems such as mangroves would have benefits in the short term, because of their importance for economic activities such as fisheries or tourism, but would also contribute to enhance resilience against natural disasters. USAID can also help develop projects and market carbon reduction certificates in areas where the private sector is currently not investing with the aim of selling them in voluntary markets, or even Kyoto-based markets, should the US ratify the Protocol.

- ### Support Efforts to Enhance Environmental Governance

Mexico's Federal Government has adopted important mechanisms to enhance transparency and accountability, including in the environment sector. However, these mechanisms have been questioned in various occasions, including during the recent debate over the ProArbol. USAID has supported Mexico's past efforts to improve governance and is well-positioned to adapt that experience to governance in the environment sector. The Environmental Transparency Initiative, co-funded by USAID, is an important first step in that direction. Additional efforts could focus on facilitating access to robust assessments of the efficiency and effectiveness of governmental programs and policies.

Environmental management is highly centralized in Mexico. USAID can help enhance the institutional capacities of state and local authorities that are willing to adopt environmental management responsibilities. The Unites States has a highly de-centralized environmental management system, from which valuable lessons can be extracted. USAID has collaborated with various state governments in the past and is well positioned to provide assistance in this area.

- ### Build Partnerships to Stimulate Markets for Sustainable Goods and Products

Most forests and important ecosystems in Mexico are property of *ejidos* and communities. A key challenge to forest and biodiversity conservation is therefore to implement actions that will enable landowners to protect biodiversity while simultaneously improving their quality of life. In addition to the adoption of legal and policy instruments that foster sustainable use of natural resources, as mentioned above, these actions should focus on helping landowners to acquire the skills and knowledge to adopt environmentally-friendly practices. Also, landowners need substantial support to sell their products and

services to markets that pay a premium price, including assistance to meet quality, volume, and time requirements. USAID has worked in this area in the past, both in Mexico and elsewhere, and is uniquely positioned to provide cutting-edge knowledge and practical experience.

In the case of forestry products, USAID can help landowners to integrate into national and international markets by supporting strategic planning and the development of community forest enterprises, vertical integration of production chains, increase in the local added value of forest products, diversification of timber and non-timber goods and environmental services, and development of common marketing strategies among *ejidos* or between *ejidos* and successful private enterprises.

An important gap that USAID can help address is the connection between consumers and producers of environmentally-sound products. Certification can strengthen this connection, but has proved challenging in Mexico because the associated costs can be very high, especially for owners of small extensions of forests or those who carry out low intensity exploitations (Small and Low Intensity Managed Forests, SLIMF). In addition, certified products do not necessarily receive a premium price. USAID can assist small producers to be certified and fulfill forest management criteria required by the certification. Also, USAID can help governments to procure certified products. This activity would not only contribute to ensure that the government purchases products of legal origin, but could also stimulate the development of markets for environmentally-sound products.

The use of market mechanisms that encourage the development of new markets for the cultivation and sale of diversified agricultural crops can sustain rare genetic resources and improve local economies. USAID could work with Mexican stakeholders to develop measures that specifically target the agricultural practices of indigenous and traditional cultures where much of the knowledge of agricultural crop diversity still resides. Public-private partnerships can be designed to improve market development for new products while simultaneously promoting conservation practices.

As for marine resources, USAID can catalyze coordination between government, NGOs and private sector partners in training activities and financial incentives to increase the capacity of fishermen and others involved in the harvesting of marine resources to apply sustainable use practices.

- ## Enhance the Capacity of Rural Communities to Sustainably Use Natural Resources

Local organization (community) and the formation of strong, respected, responsible and transparent institutions have proven to be essential factors in the preservation and sustainable use of natural resources. USAID can assist in strengthening local initiatives seeking to build institutional capacity at the local level, particularly those that aim to enhance accountability, democratic processes, local governance, and impartiality in decision-making.

It is also necessary to provide training to groups that are developing forestry community enterprises, UMAs, local payment plans for environmental services, and in general, businesses of sustainable exploitation of timber-yielding and non-timber-yielding products. Some areas that require assistance are: technical skills in managing and sustainably exploiting forests, organizational skills, entrepreneurial skills, administrative skills, and knowledge concerning laws, regulations and government application procedures.

USAID can help increase the sustainable management of forests by supporting the elaboration and execution of management plans and other planning instruments that seek to protect forests from fires, plagues, clandestine logging and illegal extraction of species. Efforts to this end could include developing surveys to identify properties and services with a productive potential in the various ecosystems and properties that are interested in adoption sustainable management practices. Also, USAID can facilitate technical assistance to develop and disseminate training tools, including manuals for the management of several kinds of forest ecosystems, extraction of timber and non-timber forest products, forest preservation, establishment of community natural reserves, UMA's, and payment plans for environmental services.

- ## Help Expand the Knowledge Base for Biodiversity and Forest Management

Mexico still needs to enhance its information and analytical base for biodiversity and forest management. There are evident gaps in areas such as marine biodiversity and genetic diversity. Even the information base for forests, which are relatively well-studied, is plagued by inconsistencies that constrain decision-making and policy improvement. In the past, USAID has supported CONABIO and other agencies to strengthen their biodiversity information base; the Agency is well positioned to continue doing so.

The research agenda has largely been shaped by governmental institutions, for example through the creation of the CONACyT-CONAFOR Research Fund (Fondo Sectorial para la Investgación, el Desarrollo y la Innovación Tecnológica Forestal). USAID can support further efforts in less researched areas, including non-timber products, market development for environmental services, possibilities of mitigation and local adaptation to climatic change, and impacts of better practices of agriculture, forestry, cattle breeding, mining, and biodiversity management, among others.

REFERENCES

Anta, S., 2007. "Áreas Naturales de Conservación Voluntaria." Available at: http://www.ccmss.org.mx/documentos/areas_naturales_de_conservacin_voluntaria.pdf

Arriaga, L., E. Vázquez, J. González, R. Jiménez, E. Muñoz and V. Aguilar (eds.), 1998. *Regiones prioritarias marinas de México*, Mexico: CONABIO.

Arriaga, L., J.M. Espinoza, C. Aguilar, E. Martínez, L. Gómez and E. Loa (eds.), 2000. *Regiones terrestres prioritarias de México*, Mexico: CONABIO.

Arriaga, L., V. Aguilar and J. Alcocer, 2002. *Aguas continentales y diversidad biológica de México*, México: CONABIO.

Barsimantov J. and J. Navia, 2007. "Cambio de uso de suelo en Michoacan, Mexico: entre la legalidad y la impunidad," *Proceedings of the VIII Congreso Mexicano de Recursos Forestales*, Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Michoacan, October 28-31.

Basurto, X. and D. Hadley (eds.), 2006. *Grasslands ecosystems, endangered species, and sustainable ranching in the Mexico-U.S. borderlands: Conference proceedings*, RMRS-P 40. Fort Collins, CO: USDA, Rocky Mountain Research Station. Available at: http://www.fs.fed.us/rm/pubs/rmrs_p040.pdf

Billings R., J. Flores, and R. Cameron, 1996. *Scarabs Pine Decorticators, emphasized on Dendroctonus frontalis: Direct Control Methods*. College Statation: Texas A&M Printing Center.

Boege, E., 2005. *La diversidad de los pueblos indígenas de México: Hacia la conservación in situ de la biodiversidad y agro-biodiversidad*, Mexico: SEMARNAT.

Bray, D. *et al.*, 2007. *Nueva Evidencia: Los Bosques Comunitarios de México Protegen el Ambiente, Disminuyen la Pobreza y Promueven Paz Social*, México: CCMSS. Available at: http://www.ccmss.org.mx/documentos/nuevas_evidencias_folleto.pdf

Brown, D. E. (ed.), 1994. *Biotic communities: Southwestern United States and northwestern Mexico*, Salt Lake City: University of Utah Press.

Carabias, J. and R. Landa, 2005. *Agua, medio ambiente y sociedad: hacia la gestión integral de los recursos hídricos*, Mexico: UNAM-El Colegio de México-Fundación Gonzalo Río Arronte.

CEC, 1997. *Ecological Regions of North America: Toward a Common Perspective*, Montreal: Commission for Environmental Cooperation. Available at: http://www.cec.org/pubs_info_resources/publications/pdfs/english/eco-eng.pdf

CCMSS, 2007. "El mercado ilegal de la madera en México," *Nota informativa número 16*, Red de Monitoreo de Políticas Públicas-CCMSS. Available at: http://www.ccmss.org.mx/documentos/nota_info_16_mercado_ilegal_de_madera.pdf

CCMSS, 2008. "Tramitología: un fuerte obstáculo para el sector forestal de México," *Nota informativa número 19*, Red de Monitoreo de Políticas Públicas-CCMSS. Available at: http://www.ccmss.org.mx/documentos/nota_info_19_tramitologia.pdf

CCMSS, Centro Geo, 2008. *La propiedad social de los bosques*. In print.

Ceballos, G. and G. Oliva (eds.), 2005. *Los mamíferos silvestres de México*, Mexico: CONABIO, Fondo de Cultura Económica.

Challenger, A., 1998. *Utilización y conservación de los ecosistemas terrestres de México. Pasado, presente y futuro*, Mexico: CONABIO, Instituto de Biología-UNAM, Sierra Madre.

Chapela, F., 2005. "Indigenous Community Forest Management in the Sierra]uárez, Oaxaca" in Bray D., L. Merino and D. Barry (eds.), *The Community Forests of Mexico*, Austin: University of Texas Press.

Chapela, G and S. Madrid, 1998. *Criterios para la caracterización del proceso de deforestación en México*. México: SEMARNAP-PNUD

CONABIO, 1997. *Provincias biogeográficas de México. Escala 1: 4 000 000*, Mexico: CONABIO.

CONABIO, 1998. *La diversidad biológica de México: Estudio de país*, México: CONABIO. Available at: http://www.conabio.gob.mx/conocimiento/estrategia_nacional/doctos/docslinea.html

CONABIO, 2004. *Programa De Trabajo Ampliado Sobre Diversidad Biológica Marina Y Costera*. México: CONABIO. Available at: http://www.conabio.gob.mx/institucion/cooperacion_internacional/doctos/b07/Diversdad_biologica_marina_y_costera.doc

_____, 2006. *Natural Capital and Human Well-Being*, México: CONABIO. Available at: http://www.conabio.gob.mx/2ep/images/6/60/NaturalCapital_17abr07.pdf

_____, 2008. *Manglares de México*. México: CONABIO. Available at: http://www.conabio.gob.mx/conocimiento/manglares/doctos/manglaresMexico.pdf

CONAFOR, 2008. *Programa Institucional 2007-2012,* Mexico: CONAFOR. Available at: http://www.conafor.gob.mx/pdfs/ProgramaInstitucional2007-2012.pdf

CONANP, 2006. *Los humedales prioritarios de México*, México: CONANP-SEMARNAT.

CONANP, 2008. *Sitios Ramsar de Mexico*. Available at: http://ramsar.conanp.gob.mx/sitios_ramsar.html

CONAPO. 2008 "Migración Mexicana hacia Estados Unidos," *Migración Internacional*. Available at: http://www.conapo.gob.mx/mig_int/03.htm

Daszak, P., A. Cunningham and A. Hyatt, 2000. "Emerging Infectious Diseases of Wildlife-- Threats to Biodiversity and Human Health," *Science*, 21 January 2000: Vol. 287. no. 5452, pp. 443 - 449

Díaz de León-Corral, A., G. Alcántar-López, P. Álvarez-Torres, L. Gutiérrez-Mariscal, D. Pedroza-Páez, S. Cortina, M. Ibánez and G. Brachet, 2005. Valoración, uso y perspectivas de la biodiversidad marina: compartiendo experiencias entre México y Latinoamérica. In E. Figueroa (ed.), 2005. *Biodiversidad marina: valoración, usos y perspectivas. ¿Hacia dónde va Chile?*, Santiago: Editorial Universitaria, pp. 59-103.

Dirzo, R. and I. Trejo, 2000. "Deforestation of seasonally dry tropical forest: a national and local analysis in Mexico," *Biological Conservation,* Vol. 94, pp. 133-142.

Dirzo, R. and P.H. Raven. 2003. "Global state of biodiversity and loss." *Annual Review of Environmental Resources,* Vol. 28, pp. 137-167.

FAO, 2005. *Evaluación de los Recursos Forestales Mundiales 2005*. *Informe Nacional: México*. Rome: FAO Forestry Department. Available at: http://www.fao.org/forestry/foris/data/fra2005/kf/common/GlobalForestA4-SPsmall.pdf

FAO, 2007. "Los manglares de América del Norte y de América Central 1980-2005: Informes Nacionales," *Working Paper 137*, Rome: FAO Forestry Department. Available at: ftp://ftp.fao.org/docrep/fao/010/ai446t/ai446t00.pdf

Ferrusquía, I. 1993. "Geology of Mexico: A Synopsis," in Ramamoorthy, T.P., R. Bye, A. Lot and J. Fa., 1993. *Biological diversity of Mexico: origins and distribution*, New York: Oxford University Press.

Flores-Villela, O. and L. Canseco-Márquez. 2004. "Nuevas especies y cambios taxonómicos para la herpetofauna de México," *Acta Zoológica Mexicana*, Vol. 20, No. 2, pp. 115-144.

Gómez-Laurito, J, Gómez L.D. 1989. "Ticodendron: a new tree from Central America," *Annals of Missouri Botanical Garden*, Vol. 76, pp. 1148–51

Gordon, R.J., Jr. (ed.) 2005. *Ethnologue: languages of the world*, fifteenth edition, Dallas: SIL International. Available at http://www.ehtnologue.com/

Grimaldi, and Engel, 2005. *Evolution of the Insects*. New York: Cambridge University Press.

Hammond, P.M., 1995. "Magnitude and distribution of biodiversity," in Heywood, V.H. (ed.), *Global Biodiversity Assessment,* Cambridge, UK: Cambridge University Press.

Heitz, P., 2002. "The Influence of Land Use on Biological Diversity in Mexico: A case study of epiphytes in coffee plantations," Vienna: Institute of Botany, BOKU. Available at: http://ann-etfrn.boku.ac.at/workshop/download/hiez.rtf

Hernández X., E. 1993. "Aspectos de la domesticación de plantas de México: una apreciación personal," in R.P. Ramamoorthy, R. Bye, A. Lot and J. Fa (comp.), *Diversidad biológica de México: orígenes y distribución*, Mexico: Instituto de Biología-UNAM, pp. 715-735.

Hernandez, C. M. E., Torres, T. L. A. and Valdez, M. G. 2000. "Meteorological Drought," in Gay C. (ed.), *Mexico: a foresight into the Twenty-first Century. Climatic change in Mexico. Results of surveys of the country's vulnerability*, Mexico: INE, SAMARA, UNAM, U.S. Country Studies Program, pp. 25-40.

Iltis, H.H., Doebley J.F., Guzmán R., Pazy B., 1979. "*Zea diploperennis* (Graminae): a new teosinte from Mexico,". *Science*, Vol. 203, pp. 186–88

INALI, 2007. *Catálogo de las lenguas indígenas nacionales: Variantes lingüísticas de México con sus autodenominaciones y referencias geoestadísticas*, Mexico: Instituto Nacional de Lenguas Indígenas.

INE, 2005. *Evaluación preliminar de las tasas de pérdida de superficie de manglar en México*, Mexico: INE, SEMARNAT. Available at: http://www.ine.gob.mx/dgioece/con_eco/descargas/informe_manglar.pdf

INEGI, 2005. *Carta de uso de suelo y vegetación [recursos electrónicos] : cobertura nacional : escala 1 :1 000 000*, Mexico: INEGI.

INEGI, 2008. *Sistema de Cuentas Económicas y Ecológicas 2003-2006*. Mexico: INEGI. Available at http://www.inegi.org.mx/prod_serv/contenidos/espanol/biblioteca/Default.asp?accion=1&upc=702825168728&s=est&c=14653

IUCN, 2008. *IUCN Red List of Threatened Species*, Gland: World Conservation Union. Available at: http://www.iucnredlist.org

Jelks, H.L., S.J. Walsh, N.M. Burkhead, S.Contreras-Balderas, E. Díaz-Pardo, D.A. Hendrickson, J. Lyons, N.E. Mandrak, F. McCormick, J.S. Nelson, S.P. Platania, B.A. Porter, C.B. Renaud, J. J. Schmitter-Soto, E.B. Taylor, and M.L. Warren, Jr., 2008. "Conservation status of imperiled North American freshwater and diadromous fishes," *Fisheries,* Vol. 33, No. 8, pp. 372-407. Available at: http://www.fisheries.org/afs/docs/fisheries/fisheries_3308.pdf

Koleff, Patricia, 2007. "Invasive Alien Species in Mexico: General Overview and Information Systems," CONABIO. Available at: http://www.nappo.org/annualmtg/2007AnnualMtg-Highlights/EduardoMorales-Mexico.pdf,

Llorente, J. *et al.* (eds.) 1996-2004. *Biodiversidad, taxonomía y biogeografía de artrópodos de México. Hacia una síntesis de su conocimiento*. Vol. I-IV, Mexico: Instituto de Biología-UNAM, CONABIO, Ecosur, Bayer, Mexico.

Manson R. and E. Jardel, 2007. Unpublished draft "Perturbaciones del habitat por causas naturales y desastres" in Sarukhán J., *Segundo Estudio* País, Mexico: CONABIO.

Martin, T. and D. Finch, 1995. *Ecology and Management of Neotropical Migratory Birds*. New York: Oxford University Press.

Martínez, E. 1989. "Lacandoniaceae (Triuridales): una nueva familia de México," *Annals of Missouri Botanical Garden*, Vol. 76, pp. 128–35.

Navarro, S.A. y A. Gordillo. 2006. *Catálogo de autoridad taxonómica de la avifauna de México*. Mexico: Museo de Zoología, Facultad de Ciencias-UNAM Museum of Zoology, Schoold of Sciences, UNAM. Base de Datos SNIB-CONABIO, proyecto CS010.

Pedroche, F.F., K.M. Dreckmann, A. Sentíes and R. Margain, 1993. "Diversidad algal en México," in Gío, R. and E. López-Ochoterena (eds.), *Diversidad Biológica en México*. *Revista de la Sociedad Mexicana de Historia Natural*, vol. XLIV (special).

Piperno, D.R. and K.V. Flannery 2001. "The earliest archeological maize (*Zea mays* L.) from highland Mexico: New accelerator mass spectrometry dates and their implications," *Proceedings of the National Academy of Science*, Vol. 28, pp. 2101-2103.

Presidencia de la República, 2007. *Plan Nacional de Desarrollo*. Available at: http://pnd.presidencia.gob.mx/

Prescott-Allen R, Prescott-Allen C. 1990. "How many plants feed the world?" *Conservation Biology*, Vol. 4, pp. 365–74

Ramamoorthy, R.P., R. Bye, A. Lot and J. Fa (eds.), 1998. *Diversidad biológica de México: orígenes y distribución*, Mexico: Instituto de Biología-UNAM.

Ramamoorthy, T.P., R. Bye, A. Lot and J.Fa. (eds.), 1993. *Biological Diversity of Mexico: Origins and Distribution*, New York: Oxford University Press.

Ramsar, 2008. *The List of Wetlands of International Importance*. Available at www.ramsar.org/sitelist.pdf

SAGARPA, 2004. *Carta Nacional Pesquera 2004*, Mexico: CONAPESCA-SAGARPA. Available at: http://www.conapesca.sagarpa.gob.mx/wb/cona/cona_carta_nacional_pesquera_2004

SAGARPA, 2007. *Programa Sectorial de Desarrollo Agropecuario y Pesquero 2007-2012*, Mexico: SAGARPA. Available at: http://www.sagarpa.gob.mx/infohome/pdf/sectorial_231107.pdf

Sánchez, J.J. and J.A. Ruiz-Corral, 1997. "Distribución del Teocintle en México," in Serratos J.A., M.A. Wilcox and F. Castillo (eds.), *Flujo genético entre maíz criollo, maíz mejorado y teocintle: implicaciones para el maíz transgénico*, CIMMYT. Available at: http://www.cimmyt.org/spanish/docs/proceedings/geneflow/contents_spa.htm

Sánchez, J.J. and L. Órdaz 1987. *El Teocintle en México. Distribución y situación acutal de las poblaciones*, Rome: IBPGR. Available at: http://www.bioversityinternational.org/publications/Web_version/266/begin.htm

Sarukhán, J. and R. Dirzo 2001. "Biodiversity-rich countries," in Levin, S.A. (ed.), *Encyclopedia of Biodiversity*, Vol. 1, San Diego: Academic Press, pp. 419-435.

SEMARNAT, 2001. *Programa Nacional de Medio Ambiente y Recursos Naturales 2001-2006*, Mexico: SEMARNAT.

SEMARNAT, 2002. Megadiversos. Memoria de la Primera Reunión Ministerial de Países Megadiversos Afines sobre Conservación y Uso Sustentable de la Diversidad Biológica, February 16-18, 2002, Cancun, Mexico. Secretariat of the Environment and Natural Resources.

SEMARNAT, 2006. *La Gestión Ambiental en México*, Mexico: SEMARNAT. Available at: http://www.semarnat.gob.mx/informacionambiental/Publicacion/Gestion_Ambiental.pdf

_____, 2007. *Programa Sectorial de Medio Ambiente y Recursos Naturales 2007-2012*, Mexico: SEMARNAT. Available at: http://www.semarnat.gob.mx/Documents/PSMAYRN%20COMPLETO/00preliminares.pdf

_____, 2007. *Estrategia Nacional para la Ordenamiento Ecológica Territorio en Mares y Costas*, Mexico: SEMARNAT. Available at: http://www.semarnat.gob.mx/queessemarnat/politica_ambiental/ordenamientoecologico/Documents/documentos%20ordenamiento/estrategia_nacional_oe_mares_costas.pdf

Spalding, M.D., C. Ravilious and E.P. Green, 2001. *World Atlas of Coral Reefs*, Berkeley: University of California Press, UNEP, WCMC.

Styles, B., 1993. "*Genus Pinus*: A Mexican purview," in Ramamoorthy T.P., R. Bye, A. Lot and J. Fa (eds.), *Biological diversity of Mexico: origins and distribution*, New York: Oxford University Press.

TNC, 2007. *Malezas de Mexico*. Available at: http://www.conabio.gob.mx/malezasdemexico/2inicio/home-malezas-mexico.htm

TNC, 2008. *Ecoregional Assessment of the Mesoamerican Reef: Marine Conservation Plan*. The Nature Consevancy, WWF, USAID. Avaialble at: http://www.tncmar.net/english/how_do_we_work/publications/ECOREGIONAL_ASSESSMENT.pdf

Toledo, V. B. Ortiz-Espejel, L. Cortés, P. Moguel and Ma.de J.Ordónez, 2003. "The multiple use of tropical forests by indigenous peoples in Mexico: a Case of Adaptative Management," *Conservation Ecology,* Vol. 7, No.3. Available at: http://www.ecologyandsociety.org/vol7/iss3/art9/

Toledo, V., J. Carabias, C. Mapes and C. Toledo, 1991. *Ecología y autosuficiencia alimentaria*, Third edition, Mexico: Siglo XXI.

Toledo, V.M., J. Carabias, C. Toledo and C. González, 1989. *La producción rural en México: alternativas ecológicas*, Mexico: Fundación Universo Veintiuno.

Torres, J.M. and A. Guevara, 2005. "El potencial de México para la producción de servicios ambientales: captura de carbono y desempeño hidráulico," Mexico: INE. Available at: http://www.ine.gob.mx/ueajei/publicaciones/gacetas/63/cap3.html?id_pub=361&id_tema=13&dir=Consultas

Trejo, R. and R. Dirzo, 2002. "Floristic diversity of Mexican seasonally dry tropical forests," *Biodiversity Conservation*, Vol. 11, pp. 2063–48.

Villaseñor, J.L., 2003. "Diversidad y distribución de las Magnoliophyta en México," *Interciencia*, Vol. 28, pp. 160-167.

Villaseñor, J.L., 2004. "Los géneros de plantas vasculares de la Flora de México," *Boletín de la Sociedad Botánica de México*, No. 75, pp. 105-135.

White, A and A. Martin, 2002. *Who owns the World's Forests? Forest Tenure and Public Forests in Transition*, Washington, DC: Forest Trends, Center for International Environmental Law. Available at: http://www.cbnrm.net/pdf/white_a_001_foresttenure.pdf

World Wildlife Fund (Content Partner); Mark McGinley (Topic Editor), 2007a. "Usumacinta mangroves," in *Encyclopedia of Earth*. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [Published: April 12, 2007; Retrieved: November 17, 2008]. http://www.eoearth.org/article/Usumacinta_mangroves

World Wildlife Fund (Content Partner); Mark McGinley (Topic Editor), 2007b. "Central Mexican wetlands," in *Encyclopedia of Earth*. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [published: March 19, 2007; Retrieved: November 13, 2008]. http://www.eoearth.org/article/Central_Mexican_wetlands

World Wildlife Fund (Content Partner); Mark McGinley (Topic Editor), 2008. "Chihuahuan desert," in *Encyclopedia of Earth*. Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). [Published : April 8, 2007;; Retrieved: November 13, 2008]. http://www.eoearth.org/article/Chihuahuan_desert

Zenteno, A., 2007. "Deforestadores silenciosos," *México Forestal*, No. 67. Available at: http://www.mexicoforestal.gob.mx/nota.php?id=436

APPENDIX 1. MEXICO THREAT ANALYSIS

Focus (Habitat types): Lowland Tropical and Subtropical Forest, Mangroves, Cloud Forest, Coral Reefs, Pine-Oak Forest, Dry Forest, Chihuahuan Desert

Species of Interest: Keystone (e.g., pollinators, seed dispersers, top predators), Red List or CITES species, Endemics, Migratory species, Umbrella species, Indicator species

KEY:

Scale / Magnitude of impacts:

Impact magnitude:	N = no impact
	L = low impact
	M = medium impact
	S = severe impact
Impact on:	C = ecological community
	I = individual species
Impact scale:	0 = less than 10 ha
	1 = 10 ha to 99 ha
	2 = 100 ha to 999 ha
	3 = 1000 ha to 9999 ha
	4 = 10000 ha to 99999 ha
	5 = 100000 ha to 999999 ha
	6 = 1000000 ha to 9999999 ha
	7 = $\geq$ 100,000,000 ha

Source of threat is Direct (D) or Indirect (I)

Affects Terrestrial (T), Marine (M), Freshwater (F) or all (A)

Timeframe (to onset of impacts and duration):

Impact onset: I = immediate = less than 6 months

S = short term = 6 months to one year

M = medium term = one to five years

L = long term = over five years

Impact duration: T = impacts are temporary, once threat is removed

E = impacts are enduring, will continue after threat is removed

Feasibility of intervention for USAID:

F = Feasible, human/financial resources available and well documented successful interventions in previous USAID projects

U = unknown, resources available, but successful interventions are limited (USAID or others)

N = not feasible, resources required are greater than available, and successful interventions not documented or limited

Rank (based on severity and scale of threat at community level and probable outcome of intervention feasible for USAID):

1 = severe impact, scale 6 or above (or degrades 75% of habitat), feasible or unknown

2 = severe impact, scale 5 (or degrades 50% of habitat), feasible or unknown,

medium impact scale 6 or above (or degrades 75% of habitat), feasible or unknown

3 = severe impact, scale 4 (or degrades 50% of habitat), feasible or unknown

medium impact scale, scale 5 (or degrades 75% of habitat), feasible or unknown

4 = severe impact, scale 3, feasible or unknown

medium impact, scale 4 (or degrades 75% of habitat), feasible or unknown

5 = severe impact, scale 1 or 2, feasible or unknown

medium impact, scale 3 or above (or degrades 75% of habitat), unknown

6 = remaining categories

Type threat	Major env. impacts	Scale of Impact	Affects T, M, F, A	Time Scale	Feasibility	Rank
Climate Change D and I	May lead to increased droughts, floods, fires, species extinctions	SC7	A	LE	Adaptation F Mitigation U	I
Land Conversion (from forest to non-forest) D	Alters nutrient cycles; alters hydrological cycles; increases sedimentation; introduction of toxins; loss of biodiversity through land conversion for agriculture, plantations, cattle ranching, infrastructure, or narcotrafficking; Eliminates coastal mangrove; eliminates fish breeding grounds; decreases productivity	SC6	A (76edi men-tation)	LE	F or U	I
Forest Fires D	May reduce biodiversity through causing local extinctions; increases sedimentation; Alters nutrient cycles; Alters hydrological cycles	SC4	A (76edi men-tation)	IT or IE	F	I
Destructive fishing practices D	Over-harvesting, leading to extinctions; coral reef degradation; loss of biodiversity	MC5 to SC5	M, F	IE	F	I
Lack of appropriate land use planning I	May lead to increased pollution, erosion, flooding, landslips, and loss of biodiversity	SC6	A	MT	F	I
Perverse Policies	May encourage forest conversion; may lead to increased environmental degradation, pollution, loss of biodiversity	MC7 to SC6	A	MT or ME	F	I

Type threat	Major env. impacts	Scale of Impact	Affects T, M, F, A	Time Scale	Feasibility	Rank
Population growth (reproduction and in-migration) I	Increases loss of biodiversity through land conversion; increases local resource extraction and may lead to environmental degradation.; increases pollution	MC7 to SC7	A	ME or LE	F	I
Heavy industry D	Alters nutrient cycles; alters hydrological cycles; increases sedimentation; introduction of toxins; loss of biodiversity through land conversion	SC5	A	MT or ME	F	2
Hunting D	May reduce biodiversity through local extinctions	SI6, MC6	A	MT	F	2
Over-harvesting D	May reduce biodiversity through local extinctions	SI6, MC7	A	MT	F	2
Invasive species D	May reduce biodiversity through causing local extinctions; May clog waterways	SI5, MC5 to SC5	A	ME	F	2
Freshwater and Aquifer depletion/ contamination D	Alters hydrological cycles, pollution, loss of biodiversity	MC7	F	Vari-able	F	2
Mining	Alters nutrient cycles; alters hydrological cycles;	SC5	A	IE	U	2

Type threat	Major env. impacts	Scale of Impact	Affects T, M, F, A	Time Scale	Feasibility	Rank
D	increases sedimentation; introduction of toxins					
Large Scale Tourism D	Increases pollution and sedimentation; may increase env. Deg.; may disturb sensitive species; may displace species or alter their reproductive cycles and migration patterns; may eliminate or alter mangroves	SC3	A	LE	U	2
Lack of enforcement/ political will I	May lead to overharvesting, increased pollution, and loss of biodiversity	MC7	A	MT	F	2
Economic I	May lead to non-sustainable harvesting of resources	MC7	A	MT or ME	F	2
Poor governance I	May lead to overharvesting, increased pollution, and loss of biodiversity	MC6	A	MT	F	2
Pests and Disease D	Weakens and kills individuals; stresses ecological communities making them less resilient; increases fire risk; may reduce biodiversity and ecological services	SC4 to LC7	A	IT or IE	F	3
Logging – Large Scale D	Alters microclimate; Damages resource base for some species; increased sedimentation*	MC5	T	IT	F	3
Mining – small scale D	Alters nutrient cycles; alters hydrological cycles;	SC3	T	IE	U	3

Type threat	Major env. impacts	Scale of Impact	Affects T, M, F, A	Time Scale	Feasibility	Rank
	increases sedimentation; introduction of toxins; may contaminate freshwater habitat of endemics					
Lack of capacity I	May lead to overharvesting, increased pollution, and loss of biodiversity	LC7 to MC4	A	MT	F	4
Eco-tourism D	Increases pollution; may increase env. Deg.; may disturb sensitive species	MC2	A	LT	F	4
Lack of knowledge/information I	May lead to increased environmental degradation, pollution, and loss of biodiversity	LI7, LC7	A	LT or LE	F	6
Cultural values I	May lead to increased environmental degradation, pollution, and loss of biodiversity	LI7, LC7	A	LT or E	F	6
Conflict over access to natural resources I	May lead to non-sustainable harvesting of resources and destruction of natural resources through violence	MC2	A	IE or IT	F	6
Roads D	Interferes with dispersal/ migration routes; Opens area up to increased hunting, logging and agriculture	SC5	T	IE	N (already in place)	
Hydro-electric dam D	Eliminates entire ecol. Com. Through flooding; alters hydrological cycles; decreases fertility of alluvial plains downstream; interferes with reproduction and dispersal of marine fauna	SC3	T, F	IE	N (dams already in place)	

Type threat	Major env. impacts	Scale of Impact	Affects T, M, F, A	Time Scale	Feasibility	Rank
Shipping canals D	Canal dredging destroys river communities; increases pollution	SC2	M	IE	N (already in place)	

APPENDIX 2. AUTHORS' INFORMATION

Santiago Enriquez is the Director of Environmental Management at the USAID Mexico Competitiveness Program. He has more than 10 years of professional experience in the design, implementation, and evaluation of public policies that address linkages among environmental protection, poverty reduction, and economic growth. Mr. Enriquez worked in Mexico's Secretariat of Environment and Natural Resources (SEMARNAT), where he managed programs to promote sustainable development along the US-Mexico border. Mr. Enriquez has worked as a consultant for the World Bank, where he supported policy-based loans and technical assistance efforts in several countries. Mr. Enriquez holds a Master's Degree in Public Policy from Harvard University.

Rosalva Landa has over 20 years of professional experience in socio-environmental analysis, water resource management and sustainable development. Since 1987 she has been working on global environmental issues and sustainability. Dr. Landa has been a professor at the *Universidad Nacional Autonoma de Mexico* (UNAM), *Universidad Autónoma Metropolitana*, *Colegio de Mexico*, *Universidad Iberoamericana* and at the *Facultad Latinoamericana de Ciencias Sociales*. Dr. Landa managed the Water, Environment and Society Program at *Colegio de Mexico*, and advised the United Nations Development Programme on national capabilities for adaptation to climate change. She also managed the SEMARNAT project "Vulnerability and climate change adaptation of rural communities in Mexico" and was advisor to the Undersecretary of Environmental Planning and Policy. Ms. Landa has a PhD. in Biological Sciences and currently advises the USAID Mexican Competitiveness Program.

Sergio Madrid has over 25 years of experience in research and policy analysis in the forestry sector. He worked for more than 10 years as an advisor in communities of northern Oaxaca in projects related to forestry and production management. Mr. Madrid coordinated forest certification in an agreement between the *Consejo Civil Mexicano para la Silvicultura Sostenible* (CCMSS) and SmartWood. For the last 15 years he has been the Executive Director of the CCMSS where he produced several studies on the Mexican forestry sector as well as public policies. Mr. Madrid holds a Master's Degree in Rural Development from the *Universidad Autonoma Metropolitana*.

Paula Meli was a member of the study group on Regional Ecology at the *Universidad de Buenos Aires*, where she implemented projects with the Argentine Chaco communities. She has lived in Mexico since 2001 and has been a consultant for environmental NGOs, including Natura, CeIBA and *the Fondo Mexicano para la Conservacion de la Naturaleza* in projects on preservation and resource management. Ms. Meli was technical advisor to the *Comision Nacional para el Conocimiento y Uso de la Biodiversidad* for the "Second Country Study" project, and has led workshops on Ecological Restoration for the *Comision*

Nacional de Areas Naturales Protegidas. Ms. Meli has a Master's Degree in Environmental Biology from the *Universidad de Buenos Aires.*

Jim Tolisano has more than 25 years of professional experience in the design and implementation of biodiversity conservation projects. He has held a wide variety of professional positions that integrate applied work in field biology, ecological monitoring, conservation project planning and management, scientific, technical and creative writing, and environmental education. He has worked in more than 30 countries as a senior advisor on conservation projects with the World Bank, United Nations, USAID, Inter-American Development Bank, World Wildlife Fund, Wildlife Conservation Society, and other international, national, local, and tribal organizations. Mr. Tolisano's most recent work is focused on integrating economic and business development measures into biodiversity conservation practice. He formerly served as an Associate Professor of Conservation Science at the College of Santa Fe, where he helped create an innovative undergraduate conservation science degree program. He serves as the Director of the Kinship Conservation Fellows, a ground-breaking environmental leadership program that integrates leadership skills with business and economic tools (www.kinshipfellows.org). He has published widely and has lectured at many universities. Mr. Tolisano holds a Master of Science in forest ecology and watershed sciences from the University of Arizona.

Carey Yeager Dr. Carey Yeager has over 25 years experience in biodiversity conservation, environmental monitoring, forest ecology, watershed and natural resource management, and project design, management and monitoring in the areas of environment, natural resources, and conservation. She has expertise in climate change (adaptation, vulnerability, and REDD), developing public-private partnerships, sustainable development, forest restoration, research design, statistical analyses, and socioeconomic surveys. She has led large multi-disciplinary teams to assess USAID programs and developed strategy documents. Dr. Yeager has designed and managed complex multi-million dollar programs, working closely with local and national governments, as well as bilateral and multilateral donors, and USG agencies. She has extensive international experience in Indonesia, Brunei, Central America, and Mexico. Ms. Yeager has a PhD. in Behavioral Ecology from the California of University, Davis.

APPENDIX 3. TERMS OF REFERENCE

PREPARATION OF AN FAA SECTION 118/119 BIODIVERSITY AND TROPICAL FORESTRY UPDATED BACKGROUND ASSESSMENT FOR USAID/MEXICO

I. Purpose and Objective

The purpose of this contract is to conduct an updated assessment of biodiversity conservation to comply with sections 118 and 119 of the Foreign Assistance Act of 1961, as amended and country strategy guidelines under ADS 201.3.4.11 and ADS 204.5. Based on this assessment, assist the Mission to define how its new five-year country program strategy contributes to conservation needs, as required by agency regulations. This assessment could also serve as a planning tool to assist USAID/Mexico in better integrating environment concerns into their overall program.

II. Background

The U. S. Foreign Assistance Act of 1961 Section 119 and Section 118, requires USAID to analyze national needs for conserving biological diversity and tropical forests and potential USAID contributions to these needs in all country strategy plans. Specifically, FAA Section 119(d), Country Analysis Requirements requires that:

"Each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of: (1) the actions necessary in that country to conserve biological diversity, and (2) the extent to which the actions proposed for support by the Agency meet the needs thus identified. (FAA, Sec. 119(d)."

Mexico ranks as the 4th most biodiverse country in the world and is surpassed only by China in the number of distinct ecosystems that it supports. The diversity of Mexico encompasses marine, desert, temperate and tropical forests as well as fresh water aquatic resources. This rich natural resource base is intricately linked with the economic system of the country and supports a dense human population. The USAID program in Mexico, during its more than 18 year existence, has focused much effort on biodiversity and forestry, but increasingly the economic growth, competitiveness, governance, health, energy and microfinance sectors are gaining importance in the overall program. The new strategy being developed will address some of these sectors and will focus on the linkages and synergies between them, with particular attention to water, forests, renewable energy and climate change under a general scope related to Mexico's competitiveness.

Mexico has dedicated a significant effort to the development of laws and programs that are working toward the overall conservation of biological resources. Examples include the formation of: the Commission on the Knowledge and Use of Biological Diversity (CONABIO); the National Commission on Natural Protected Areas (CONANP); the National Forest Commission (CONAFOR) and an integrated Ministry of the Environment (SEMARNAT) that manages national policy for air, land and some water resources in the country. Mexico is an active participant in several international environmental agreements. It was the first country to sign the Convention on Desertification and is a signatory on the Conventions dealing with Climate Change and Biodiversity Conservation, and has been working in concert with other nations on international forestry accords. Internally, Mexico has worked to develop and improve its national statistical base on biodiversity and water resources, to measure its contributions to greenhouse gases and to inventory its forest resources on a regular basis. Despite these actions, Mexico has one of the highest rates of deforestation and land degradation and is one of the leading GHG emitters in the developing world. Current climate change models predict that Mexico will suffer increased drought and catastrophic floods and fires in the future that will further impact its forest and biological resources. Understanding how global climate change, as well as other future changes will impact the richness of Mexico's natural resource base is vital.

The "*Biodiversity and Tropical Forest Conservation, Protection and Management in Mexico: Assessments and Recommendations*" produced in 2002 will serve as the base document for this updated assessment and will be provided by the USAID Mission together with other analyses including "*The Political Context for Environmental Policy Decision-Making in Mexico: A Stakeholder Assessment*" produced in 2003.

This updated assessment will also be aided by the data that already has been produced by institutions, government and other conservation organizations in Mexico and from the work already accomplished by USAID and other donors.

The "*Program and Partnership Assessment and Strategic Options Development Analysis*" carried out under USAID's EPIQ activity by International Resources Group (IRG) at the start of FY02 will also serve as an input for this updated assessment.

The proposed study will build from the foundation of these assessments to synthesize other updated information available on the biological and forest resources in Mexico, their current status, and the recognized pressures impacting them. It will include the actions and potential actions of the overall Mission program, not just environment.

Particular attention should be paid to large-scale development plans, such as the new infrastructure fund recently announced by President Felipe Calderon.

III. Statement of Work

Under the direction of a team leader, the assessment team shall evaluate biodiversity and tropical forest concerns in Mexico. The focus of all activities taken under this assignment is two fold:

1) To identify actions necessary to conserve biodiversity, and

2) To describe how and to what extent actions proposed in the country strategic plans meet, or could meet, the biodiversity needs thus identified.

The assessment team shall perform the following activities:

A) Review data collected by previously contracted consultants:

1. Review documentation of meetings with USAID/Mexico staff carried out under previous 118/119 assessment preparation contract. The purpose of those meetings was to get an understanding of the Mission's ongoing sectoral assessments, program goals and objectives under its proposed strategy. The Mission also may provide the team with advice and protocol on approaching USAID partners and host country organizations with respect to this assignment. The team shall be aware of sensitivities related to an assessment exercise and respect Mission guidance and time constraints. The team will discuss organizations to be contacted and any planned site visits with the Mission and coordinate as required.

2. The Mission's Natural Resources Advisor and/or Environment Officer will facilitate meetings with other areas at USAID to allow the team to gain a full understanding of the country program and strategy. The Mission's Natural Resources Advisor and/or Environment Officer will help facilitate interaction and information exchange with any other assessment teams in the field as necessary. They will also facilitate consultations with other USAID environment and economic growth staff in Washington and other missions to gather information on regional programs and agency environmental regulations.

3. Obtain, review and analyze existing documentation on biodiversity conservation (and tropical forest conservation) in Mexico, such as that prepared by government agencies, bilateral donors, and national and international NGOs. Examples of such documentation may include the National Biodiversity Conservation Strategy and the Natural Capital and Social Welfare document (CONABIO, 2006); Environmental Management in Mexico (SEMARNAT, 2006), Global Environment Fund (GEF) project reports; reports by conservation NGOs, etc.

4. Incorporate information gathered through meetings with relevant ministries and agencies, donor organizations, NGOs, and other organizations which are involved in forest and biodiversity conservation, cross-cutting issues, or which are implementing noteworthy projects, and gather relevant information.

5. Conduct one to three priority site visits, if necessary, to supplement the understanding gained from interviews, literature, and other second-hand sources.

B) Analysis:

Summarize the status of biodiversity and tropical forests in Mexico including the state and issues concerning marine and coastal resources. Summarize the social, economic, institutional, legal, and policy context for their use and conservation, including actions currently being taken by government, other donors, NGOs, and the private sector. Identify the key direct and indirect threats to biodiversity (and tropical forests). Identify the actions necessary to conserve and sustainably manage natural resources and biodiversity and tropical forests in Mexico in the current context, based on an analysis of country donors and NGO responses to meet these needs. Prepare a report on the status of biodiversity conservation efforts in Mexico and implications for USAID or other donor programming and environmental monitoring which shall define the actions necessary for conservation.

C) Report:

Prepare a report describing the analysis and conclusions. This report shall clearly meet the legal requirement of FAA Sections 118 and 119 by answering the following:

(1) What are the significant threats to tropical forest sustainability and biological diversity conservation?

and

(2) how can these threats be addressed and resolved via USAID involvement?

The report should be no more than 50 pages in length (excluding appendices), and shall include sections covering the following topics:

Title Page, including the date of completion of the analysis report

Table of Contents

A. Introduction, describing the purpose of the analysis and methods used in conducting it, including the timing of the analysis in relation to the timing of USAID strategy development.

B. An updated overview of the status of biodiversity in Mexico, including ecosystem diversity, species diversity, threatened & endangered species, genetic diversity, agricultural biodiversity, ecological processes and ecosystem services, and values and economics of biodiversity and forests. An overview of the status of marine and coastal resources should also be included. A map of potential natural vegetation and of land use or land/forest cover should be provided if available.

C. An updated overview of the social, economic, and political context for sustainable natural resources management and the conservation of biodiversity and forests in Mexico, including the social and economic environment; institutions, policies, and laws affecting conservation; the national protected area system including all IUCN categories of protected areas; laws affecting the protection of endangered species; and participation in international treaties. A map of the protected areas system should be provided if available.

D. A review and summary of government, NGO, and donor programs and activities that contribute to conservation and sustainable natural resources management, and an assessment of their effectiveness, strengths, and weaknesses.

E. An assessment of the threats to biodiversity, including direct threats and indirect threats or root causes of the direct threats.

F. A list or description of the actions necessary to conserve biodiversity and forests in Mexico, logically flowing from the review of the threats, and what is currently being done by government, NGO, and donor programs that address those threats.

G. A review of the proposed USAID/Mexico strategy and program followed by an analysis of the extent to which actions proposed for support by USAID help meet the needs identified in F. This section

should also point out any threats to biodiversity and forests from activities proposed for USAID support, and suggest mitigating actions. It should also identify opportunities for cross-cutting, cross-sectoral linkages with proposed activities, especially those that would be low cost and/or would enhance the effectiveness of the proposed activities.

H. All references used and cited in the report should be listed; web URLs for information resources should also be provided.

I. Appendices to the report should contain, at minimum:

The SOW for the analysis,

Biographical sketches of analysis team members,

A list of persons contacted and their institutional affiliation,

Other background or supporting material as needed.

** Further notes or requests for information to be included in analysis report may be added as desired by the Mission.

IV. Methodology

A fully bilingual, two-person team with the following composition and expertise is required to conduct this analysis:

International/Local Technical Assistance (1 person). Senior Level Natural Resource Management Specialist with post-graduate qualifications in biology, zoology, forestry or closely related field in natural resource management or natural resource economics. Background in tropical biodiversity and natural resource conservation. Knowledge of USAID Strategic Planning process related to Tropical Forestry and Biodiversity (FAA Sections 118 and 119) desirable. Knowledge of 22 CFR 216 and of FAA 117 is also desirable. Demonstrated expertise in assessing development programs for impacts on environment and tropical ecosystems. Experience in Mexico necessary.

Local Technical Assistance (1 person). Senior Level Natural Resource Management Specialist with demonstrated experience in Mexico's environmental law, the policy and legal frameworks governing environmental management in Mexico and the analysis of relevant policies. Good contacts within Mexican government agencies, NGOs, international donors, and private sector preferred.

V. Timing

The Updated Biodiversity and Tropical Forest Background Assessment Study should be completed in draft no later than November 30, 2008 and in final no later than March 31, 2009.

VI. Illustrative Level of Effort

USAID anticipates that the updated assessment can be completed in approximately 5 weeks by a team of two persons as described in IV.

VII. Relationships and Responsibilities

The Contractor(s) shall report to the USAID/Mexico Natural Resources Advisor or his designee. The Contractor will be responsible for identifying and obtaining the majority of the reference materials needed for this study with only minimal interventions on the part of the USAID/Mexico Environment Team. USAID/Mexico will provide a letter of introduction to the GOM Agencies and other institutions being called upon to collaborate in providing information for this study.

VIII. Deliverables

There shall be three Deliverables under this contract:

1 – Workplan and Schedule: The Contractor shall provide USAID with a Workplan and Schedule within 5 days of contract inception. The Workplan and Schedule shall be 3-5 pages long, and shall include a week-by-week listing of major activities by location (Mexico City, other), including any planned site visits, and shall highlight planned interaction with USAID on no less than a weekly basis. The Workplan and Schedule shall also include a preliminary report outline.

2 – Draft Report: The Contractor shall submit a Draft Report at the end of the fourth week of the contract. The Draft Report shall follow the generic outline provided in the attachment to this SOW (See Annex 1. Tropical Forestry and Biodiversity Analyses: Lessons Learned and Best Practices from Recent USAID Experience, Appendix 4), as refined during the course of the contract in consultation with USAID. The Report shall_not exceed fifty pages, in English and 50 pages in Spanish not including Annexes., Suitable annexes and figures (maps, institutional charts, tables) and references should be attached to the report. The expected annexes should include a briefly annotated bibliography of the most important current reference materials related to the topic and a contact list for each of the organizations discussed in the Report.

3 – Final Report: USAID will provide its comments on the Draft Report within 5 working days of receipt of the Draft. The Contractor will then have 5 days to incorporate the comments and submit the Final Report.

The Contractor will furnish both electronic file versions of all submissions (first draft and final report) and five copies, including one photocopy ready version of the Final Report.

APPENDIX 4: INTERVIEWS AND ORGANIZATIONS CONTACTED[18]

Contact	Organization
Ricardo Hernández, Chiapas Program Manager	Conservation International (CI)
Rosario Álvarez, General Manager Juan Beazaury, Policy Officer	The Nature Conservancy (TNC)
Jorge Rickards, Conservation Program Director	World Wildlife Fund (WWF)
Eduardo Cota, Conservation and Restoration Program Officer	ProNatura
Renee González, Natural Protected Areas Fund Manager Juan Manuel Frausto, Fire Management Program Manager	Fondo Mexicano para la Conservación de la Naturaleza
Celia Piguerón, Director of Programs	British Embassy in Mexico
Ricardo Hernández, Senior Environmental Specialist	World Bank
Carlos Enríquez, General Director for Conservation and Development Flavio Cházaro, General Director for Institutional Strengthening Roberto de la Maza, General Director of Strategic Projects	CONANP
Antonio Díaz de León, General Director for Regional and Sectorial Planning	SEMARNAT
Eduardo Morales, Coordinator of Information and External Services Humberto Berlanga, Coordiantor of the North American Bird Conservation Initiative-Mexico Hesiquio Benitez, Director and Liaison for International Affairs	CONABIO

[18] All interviews were conducted by consultants sub-contracted by the *Fondo Mexicano para la Conservación de la Naturaleza* (FMCN) between June 6 and July 7, 2008.

Pedro Álvarez Icaza, General Director of Corredor Biológico Mesoamericano-Mexico Xóchitl Ramírez, Corredor Biológico Mesoamericano-Mexico	
Carlos González Vicente, Coordinator for Conservation and Restoration	CONAFOR
Francisco Chapela, National Project Coordinator	COINBIO
Francisco J. Roaro Meza, Coordinador de Evaluación de - Programas FAO SAGARPA, Yucatán	SAGARPA
Nancy Alvey, Health Team Leader Elizabeth Bauch, Municipal Finance Advisor Jeffrey Bell, Deputy Mission Director Victor Bullen, LAC Bureau Environment Officer Geoffrey Chalmers, Microenterprise Development Advisor Jorge Landa, Energy Advisor Nora Pinzón, Education Team Leader Babette Prevot, Program Officer Susan Wofsy, Natural Resources Advisor	USAID/Mexico

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