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GUATEMALA BIODIVERSITY AND TROPICAL FOREST ASSESSMENT

May 2010

This report was produced for review by the United States Agency for International Development (USAID). It was prepared by International Resources Group (IRG) in collaboration with Abt Associates.

GUATEMALA BIODIVERSITY AND TROPICAL FOREST ASSESSMENT

Consultants:
James Tolisano, Biodiversity Specialist/Team Leader
María Mercedes López – Selva, Conservation Biologist

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ACRONYMS

A/R	Afforestation or Reforestation of deforested areas
ACARPET	Asociación de Carpinteros de Petén
ACOFOP	Asociación de Comunidades Forestales de Petén
ADISO	Association for the Integrated Sustainable Development of the East
AMSCLAE	The Authority for the Sustainable Management of the Atitlán Watershed and it Tributaries
ANACAFE	Guatemalan National Coffee Association
ANAM	National Association of Municipalities
ARNPG	Association of Private Natural Reserves of Guatemala
ASAECO	Association of Ecological Agriculturists of Lake Chicabal
ASOREMA	National Association of Non-Governmental Organizations Natural Resources and Environment consortium
BFD	Belize Forest Department
CAFTA	Central American Free Trade Agreement
CAM	Central America and Mexico
CATHALAC	Water Center for the Humid Tropics of Latin America and the Caribbean
CBD	Convention on Biological Diversity
CBOs	Community-based organizations
CCAD	Central American Commission for the Environment and Development
CDM	Clean Development Mechanism
CECON	Center for Conservation Studies
CEMEC-CONAP	Centro de Monitoreo y Evaluacion del Consejo Nacional de Areas Protegidas
CI	Conservation International
CITES	Convention on International Trade in Endangered Species of Fauna and Flora
CONAP	National Council for Protected Areas
CONCAUSA	Joint Declaration Central America and United States of America ().
CPI	Counterpart International
DANIDA	Danish International Development Assistance
DIPRONA	Directorate of Nature Protection
DR	Dominican Republic
EGAT	Bureau for Economic Growth, Agriculture and Trade (
EIAs	Environmental impact assessments
FAA	Foreign Assistance Act

FCA	Forest Conservation Agreement
FCD	Friends for Conservation and Development in Belize
FCER	Forest-based carbon emission reduction project
FCG	The Guatemala Conservation Trust Fund
FCPF	Forest Carbon Partnership Facility
FDN	Fundación Defensores de la Naturaleza
FEDECOVERA	Federación de Cooperativas de las Verapaces
FOGUAMA	The Guatemalan Environment Fund
FONACON	National Conservation Fund
FSC	Forest Stewardship Council
FUNDAECO	Fundación para el Desarrollo y la Conservación
FUNDARY	Fundación Mario Dary
GEF	Global Environment Facility
GGEs	Greenhouse gas emissions
GIS	geographic information system
GNP	gross domestic product
GoG	Government of Guatemala
GTZ	German Technical Development
ICDPs	Integrated Conservation and Development Initiatives
IDB	Inter-American Development Bank
IETA	International Emissions Trading Association
INAB	The National Forest Institute
INGUAT	Instituto Guatemalteco de Turismo
IPCC	Intergovernmental Panel on Climate Change
IR	Intermediate Result
IUCN	International Union for Conservation of Nature
JAPOE	Council for Administration of Water and Sewage Disposal (Jesús de Otoro, Honduras)
JICA	Japan International Cooperation Agency
LKS	lesser-known species
mm	meters
MAGA	Ministry of Agriculture, Livestock and Food
MAREA	Management of Aquatic Resources and Economic Alternatives Program
MARN	Ministry of Environment and Natural Resources
MBC	Meso-American Biological Corridor

MBR	Maya Biosphere Reserve
MMCBR	Maya Mountains–Chiquibul Biosphere Reserve
MRV	Measurement, reporting and verification
MTPA	Montecristo Trinational Protected Area
MUZ	Multiple Use Zone
NFP	National Forest Program
NGOs	Non-governmental organizations
NGS	National Geographic Society
NISP	National Implementation Sustainable Partnership
NORAD	Norwegian Agency for Development Cooperation
NRM	Natural resource management
NTFPs	Non-timber Forest Products
ODK	(Google Android) Open Data Kit
OETE	Office of Enterprise, Trade and the Environment
PES	Payment for environmental services
PINFOR	Program for Forestry Incentive
PINPEP	Small Stakeholder Incentives Program
PNRs	Private Natural Reserves
PPAFD	Pilot Program of Direct Support for Forests
RPIN	REDD - Project Identification Note
RA	Rainforest Alliance
REDD	Reduced Emissions from Deforestation and Land Degradation
SEMARNAT	Secretaría de Medio Ambiente y Recursos Naturales (Mexico)
SIG	Geo-referenced Information System
SIGAP	Guatemalan System of Protected Areas
SIGSA	Health Management Information System
SIPECIF	National System for the Prevention and Control of Forest Fires
SMEs	small and medium enterprises
SO	Strategic Objective
TBCAs	Transboundary conservation areas
TFCA	Tropical Forest Conservation Act
TNC	The Nature Conservancy
UNFCCC	United Nations Framework Commission on Climate Change
UNIPESCA	Ministry of Agriculture - Fish and Aquaculture Management Unit

USAID	US Agency for International Development
UVG	Universidad del Valle of Guatemala
V&A	Vulnerability and Adaptation
VCS	Voluntary Carbon Standard
VER	Voluntary emission reduction
WBI	The World Bank Institute
WCS	Wildlife Conservation Society
WWF	World Wildlife Fund
WWF/G	World Wildlife Fund/Guatemala

PREFACE

The assessment on the state of biodiversity and tropical forests in Guatemala was prepared for the United States Agency for International Development (USAID) Mission in Guatemala, and addresses the requirements set forth in Sections 118 and 119 of the 1961 Foreign Assistance Act (FAA) that establish the guidelines for U.S. actions affecting the issues of tropical forests and biodiversity. These regulations are presented in **Annex II.** The assessment builds directly from the Guatemala Biodiversity and Tropical Forestry Assessment delivered to USAID in September 2002 and modified in December 2003, and principally aims to update the valuable information and guidance provided in this earlier report.

A comprehensive analysis of literature pertaining to Guatemalan biodiversity and tropical forests forms the primary input for the assessment. Additional information was obtained from consultation with specialists, government authorities, non-governmental organizations (NGOs) and bilateral and multilateral donors. The findings are summarized in six sections. Section One provides a concise summary of the purpose and approach used in preparing the report. Section Two provides an overview of Guatemalan biological diversity and tropical forests. Section Three describes the various efforts being taken by government and NGOs, civil society, and private landowners to conserve biodiversity and tropical forest resources. Section Four identifies the main threats to biodiversity and tropical forest conservation in Guatemala, and the potential consequences from each threat. Section Five reviews actions that can be taken to mitigate, minimize or eliminate these threats and enhance conservation objectives. Section Six examines options for USAID to engage in biodiversity and tropical forest conservation in Guatemala, and demonstrates links between threats; underlying social, economic and institutional factors driving these threats; and opportunities to take actions against each threat.

EXECUTIVE SUMMARY

PURPOSE OF THE ASSESSMENT

The Guatemala Biodiversity and Tropical Forest Assessment of 2009 has been prepared to assist the USAID/Guatemala Mission to respond to the requirements included in Sections 118 and 119 of the FAA. Specifically, the present report aims to achieve the following results:

- Fulfill the Mission's legal requirements set under Sections 118 and 119 of the FAA
- Alert the Mission to possible environmental compliance needs that may emerge under USAID's environmental assessment and compliance regulation 22 CFR 216, for activities that could either directly or indirectly threaten biodiversity or tropical forests
- Identify opportunities for using funds earmarked by Congress for biodiversity or tropical forest conservation
- Identify opportunities for increasing the sustainability across all development sectors, including democracy and governance, economic growth, health, disaster preparedness, and conflict mitigation and management

The information included in the 2009 assessment primarily aims to support USAID's efforts to increase sustainability across all sectors.

BIODIVERSITY AND TROPICAL FORESTS IN GUATEMALA

Guatemala's topography varies greatly due to the Sierra Madre Mountains that divide into two large branches, one that goes through the central highlands and another that becomes the Sierra de los Cuchumatanes, the highest mountain chain in Central America. Other important features of Guatemala are the 37 volcanoes that give the country a wide variety of altitudes, extending from sea level to 4,220 meters (mm). The volcanoes and Sierra de los Cuchumatanes have been identified as areas of high endemism, making the country part of the second most important biodiversity hotspot of the world for its biological richness, endemism, and endangerment.

Guatemala's geographic position between two large areas of land and between two oceans; the many microclimates that originate from having many altitudes in small areas combined with an average temperature of 24°C; and an annual precipitation of 500 mm to 6,000 mm all contribute to the richness of the country in terms of biodiversity. A total of 10 physiographic regions, seven biomes, 14 ecoregions, 66 ecosystems, and 14 life zones have been identified in the country and the list of new species for the country and for the world grows constantly. Thirty-eight principal watersheds drain to the Pacific Ocean, the Caribbean Sea, and the Gulf of Mexico in the Atlantic Ocean.

BIODIVERSITY CONSERVATION EFFORTS IN GUATEMALA

In Guatemala *in situ* and *ex situ* biodiversity and tropical forest conservation are principally carried out under the jurisdiction of the Ministry of Environmental and Natural Resources (MARN), and the associated National Council for Protected Areas (CONAP), along with the National Forest Institute (INAB) administered by a multitude of agencies within the Government of Guatemala (GoG). Several sub-national government and civil society efforts, including several prominent national non-governmental organizations dedicated to biodiversity conservation, also figure prominently in the conservation of biodiversity and tropical forests, particularly the community organizations managing

large areas of government-allocated forest concessions in the Petén region, and the consortium of private nature reserves that have been set up throughout the country. The international conservation NGOs with important forest and biodiversity conservation programs, and currently working closely as partners of USAID include Rainforest Alliance (RA), and the Wildlife Conservation Society (WCS). Counterpart International (CPI) also continues to field programs financed with assistance from USAID that include important elements to help support biodiversity conservation. Other international conservation NGOs with active programs in Guatemala include Conservation International (CI); The Nature Conservancy (TNC) and World Wildlife Fund (WWF). In Guatemala, *ex situ* biodiversity conservation is carried out through two seed banks, five zoos, 14 fauna breeding facilities, one faunal rescue center, one botanical garden, 57 breeding grounds for ornamental flora, 21 breeding grounds for forest species of different use, four herbaria, two natural history museums, two insectaries, two living reptile collections, two arboreta, 64 private collections of fauna, and various field plantations.

The Guatemalan System of Protected Areas (SIGAP) is the principal mechanism through which *in situ* conservation is carried out in Guatemala. The SIGAP now includes more than 180 protected areas, which cumulatively comprise more than 36,000 km^2. This extension constitutes approximately 33% of the national territory. The SIGAP's objectives are to conserve biodiversity and to protect representative samples of the country's ecosystems, chosen for their biological richness or for the environmental goods and services they generate.

National Council for Protected Areas (CONAP) has delegated the co-administration of protected areas to six NGOs, 14 Municipalities, and five other governmental organizations. *In situ* conservation methods being applied through CONAP in Guatemala also include several biological corridor initiatives, seven wetlands listed in the RAMSAR Convention, and the promotion of habitat enhancement practices within various traditional agriculture and agroforestry systems.

However, despite the strong conservation agenda articulated for Guatemala, there are several shortcomings that could constrain the results from conservation efforts. The SIGAP has significant ecological gaps in terrestrial, freshwater, and marine ecosystems. Other significant constraints include insufficient budgets to carry out mandates, incomplete data to support planning and decision-making, insufficient and poorly trained personnel to implement management needs, insufficient equipment and infrastructure to carry out research activities, and limited personnel and infrastructure resources to support stakeholder collaboration; and therefore, limited resources to effectively formulate and carry out national conservation planning. Another challenge faced by CONAP and the SIGAP is a general lack of political and public support, which translates into a lack of necessary financial resources to support management mandates.

The operating mission of INAB focuses on sustainable development of the nation's forest resources, taking into account ecological and social factors. INAB suffers from insufficient human resources, equipment, and capacity, particularly in the more remote and extensively forested areas of Guatemala. The agency serves as the lead institution in the implementation of Guatemala's National Forest Program, within which the Program for Forestry Incentives (PINFOR) and the small stakeholder incentives program (PINPEP) have emerged.

Forest ownership in Guatemala is divided into three major categories: (1) private forests, (2) national forests, and (3) communal or municipal forests (Table 3.3). Forest types and management goals differ significantly throughout the country. For example, the community-managed forests in the highlands consist mainly of coniferous or mixed forests and principally produce firewood and construction wood for household consumption and the domestic market. In contrast, the community-managed forest operations in the Petén region consist largely of broadleaved forests, including several hundred thousand hectares of forest areas within the Maya Biosphere Reserve (MBR), and produce precious woods and

lesser-known species (LKS) for the national and international market, along with extensive production of non-timber forest products (NTFPs). Guatemala's forest sector, combining timber and NTFPs, is estimated to contribute approximately 2.5% of the gross domestic product (GDP). It generates an estimated 37,000 jobs, involving slightly more than 1% of the economically active population.

Guatemala signed the Convention on Biological Diversity (CBD) in 1993, and has also signed the Convention on International Trade in Endangered Species of Fauna and Flora (CITES), the RAMSAR Convention on Wetlands, and the Kyoto protocol to mitigate the impact of greenhouse gas (GHG) emissions on the global climate.

The principal national legal mechanism supporting the management and conservation of biodiversity in Guatemala is the 1989 Protected Area Law (Decreto 4-89) and its revisions. The Protected Area Law is generally compatible with other important biodiversity and forest conservation laws and policies in Guatemala, including the national Forest Management law, the law for conservation of Natural and Cultural Patrimony, and the organic law creating the Ministry of Environment. However, other laws such as the Mining and Hydrocarbon law and the Fisheries Act do result in some conflict due to the promotion of resource exploitation in and adjacent to protected areas. Unfortunately, few of the many existing laws and policies pertaining to agriculture and rural development provide specific guidance or support for biodiversity or forest conservation, with the exception of some broad-sweeping endorsements of the importance of sustainable uses of natural resources.

THREATS TO THE CONSERVATION AND SUSTAINABLE MANAGEMENT OF BIODIVERSITY AND TROPICAL FORESTS IN GUATEMALA

Guatemala faces significant trans-national and national threats to the conservation of biodiversity and tropical forests. The most significant trans-national threats include direct and indirect impacts from climate change; the illegal trade in wildlife, timber and non-timber forest resources; and the indirect impacts from the illegal trade in narcotics.

The most significant nationally-based threats to the conservation of biodiversity and tropical forests in Guatemala include the following:

- Habitat loss, degradation and fragmentation – specifically resulting from unmanaged fires, land conversion for agriculture and cattle, land conversion for mineral and petroleum development, the introduction of exotic or opportunistic species, and drug trafficking.
- Over-exploitation of natural resources – specifically due to poorly managed forest product harvests, unregulated hunting of wildlife, wildlife collection for illicit national and international markets, and poorly regulated harvests of marine resources.
- Environmental contamination from poorly managed liquid, solid, and atmospheric wastes; agricultural runoff; and poorly regulated mineral and petroleum development.

Each of these factors is strongly influenced by the cumulative interaction of four social and institutional drivers:

- Pervasive poverty and lack of economic opportunities
- Weak environmental management institutions
- Inadequate or ineffective policies

- Lack of coordinated land and resource use planning and management
- Unregulated human population growth and migration
- Lack of verified land titles

These six social and institutional factors represent root causes stimulating and driving all threats to biodiversity and tropical forests in Guatemala.

OPPORTUNITIES TO REDUCE OR MITIGATE THREATS

In recent years, USAID's environment program in Guatemala has supported environmentally sound management of natural resources in several priority areas of great biodiversity, including the MBR in the Petén, the Motagua-Polochic system (which includes the Sierra de las Minas Biosphere Reserve), and the Atitlán Volcanoes Bioregion. USAID's program also provided assistance to develop sustainable income generation alternatives to people living in and around protected areas. These include efforts to establish carbon credit initiatives, certify timber production, control forest fires, develop non-traditional forest products, encourage tourism, and promote environmentally sound production practices.

USAID/Guatemala is currently reviewing its plans and strategies for interventions in sectors that can affect biodiversity and tropical forests in Guatemala. USAID is currently engaged in a variety of initiatives in Guatemala and regionally designed to respond to threats from climate change; strengthen benefits from sustainable tourism; reduce threats from uncontrolled fires and habitat degradation; and improve the development of sustainable natural resource enterprises, particularly those relying on the harvest and sale of timber and non-timber forest products. The assessment includes a review of opportunities and interventions that can strengthen the conservation and management of Guatemala's rich biodiversity and tropical forests. The review of opportunities serves as a possible "menu of options" for the Mission to consider in planning future initiatives. Some of the opportunities evaluated include:

- Measures to strengthen institutional capacity and infrastructure necessary to mitigate, reduce or enhance adaptation to the impacts from climate change
- A market-driven conservation strategy designed to generate income and other financial benefits from activities such as the sustainable harvest of timber and non-timber forest products; payments for environmental services; tourism and other revenues from public and private protected area management; reforestation and natural forest regeneration
- Measures to strengthen the application of environmental policies, including development of a unifying national policy and improved institutional coordination
- Measures to strengthen environmental management institutions, including improved monitoring and decision making with strengthened environmental information systems; improved land and marine resource use regulation; national and regional biological corridor initiatives; and greater use of transboundary and regional initiatives to achieve conservation goals
- Reduced poverty and improved land use through greater engagement of civil society in biodiversity and forest conservation, including measures to promote public participation in the environmental agenda; strengthening participation of community-based organizations (CBOs) by replicating the forest concession model; strengthened management and administrative skills in producer groups; legalization and titling of lands in and adjacent to protected areas; and direct interventions in ecosystem protection, such as fire prevention and control, and restoration of degraded areas.

1. USAID'S ROLE IN PROTECTING BIODIVERSITY AND TROPICAL FORESTS IN GUATEMALA

In 1987, Sections 118 and 119 were added as amendments to the Foreign Assistance Act of 1961 (FAA) and mandated Congress and the US Agency for International Development (USAID) to carry out a country analysis related to the conservation and sustainable use of tropical forests and biological diversity. The required country assessments specifically request an analysis of the actions necessary to achieve conservation and sustainable management of tropical forests in that country, and a determination of the extent to which the actions proposed for support by the Agency meet the identified needs. The complete text of Sections 117, 118, and 119 of the Foreign Assistance Action as amended in 2003 are included in Annex I.

1.1 PURPOSE OF THE ASSESSMENT

The Guatemala Biodiversity and Tropical Forest Assessment of 2009 has been prepared to assist the USAID/Guatemala Mission to respond to the requirements included in Sections 118 and 119 of the FAA. Specifically, the present report aims to achieve the following results:

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- Identify opportunities for increasing the sustainability across all development sectors, including democracy and governance, economic growth, health, disaster preparedness, and conflict mitigation and management)

The latter factor is of critical importance for all Mission activities. Biodiversity conservation is synergistic with all other development activities. All social and economic development takes place within natural ecosystems, some more highly modified than others, but all are subject to the limitations which operate within natural systems. Long-term sustainable development requires the conservation of the variety and variability of life, and the irreplaceable environmental services biodiversity and tropical forests provide to humans. The information included in the 2009 assessment primarily aims to support USAID's efforts to increase sustainability across all sectors.

1.2 METHODS USED TO CARRY OUT THE ASSESSMENT

A two-person team collaborated to prepare the assessment from September 13 – December 11, 2009. The team carried out a thorough review of literature pertaining to biological diversity, tropical forests, and social, institutional, and environmental conditions in Guatemala. The team also consulted with a wide spectrum of representatives from government, international, and national non-governmental and civil society organizations, donor and development agencies, private business, and rural communities. Interviews and consultations produced additional technical information, and assisted the team to identify

perceived threats to biodiversity and tropical forests in Guatemala, and potential responses to mitigate or reduce threats. A stakeholder workshop engaging many of the representatives consulted was carried out on November 4, 2009. The workshop allowed stakeholder representatives to review initial findings and provide commentary on proposed recommendations. Revisions from USAID to the final draft were made in November 2009 and after including their comments a final report was presented to USAID in May, 2010.

The assessment was carried out by James Tolisano, Biodiversity Conservation Specialist and Team Leader, and Maria Mercedes Lopes-Selva, Biodiversity and Sustainable Development Specialist, with support from Juan Carlos Mendez, Natural Resource Specialist, Carmen Lopez, Environmental Specialist, and Carey Yeager, Environment and Climate Change Specialist. Draft and final reports were revised by Teresa Robles, Land Tenure and Natural Resources Policy Advisor, USAID/Guatemala; Peter Keller, Biodiversity Advisor, USAID Bureau for Latin American and the Caribbean; and Paul J. Schmidtke, Regional Environmental Advisor, USAID/Central America. The assessment was realized under the Guatemala Trade and Competitiveness Expert Services Assistance Project administered by Abt Associates, prime contract EDH-I-03-00005-00, and specifically through ABT-IRG sub-contract 18058. A biographical summary of the principal assessment team is included in Annex II to this report. The original Scope of Work assigned to the team is included in Annex III. A list of individuals and organizations consulted to assist with data collection and analysis is included in Annex IV. A list of participants in the November 4, 2009 stakeholder workshop is included in Annex V.

The remainder of this report provides the core of the 118-119 assessment. Section Two provides an overview of the state of Guatemalan biological diversity and tropical forests. Section Three describes the various efforts being taken by government and NGOs, civil society, and private landowners to conserve biodiversity and tropical forest resources. Section Four identifies the main threats to biodiversity and tropical forest conservation in Guatemala, and the potential consequences from each threat. Section Five reviews actions that can be taken to mitigate, minimize or eliminate these threats and enhance conservation objectives. Section Six provides a concise menu of options for USAID to engage in biodiversity and tropical forest conservation in Guatemala, and demonstrates links between threats; underlying social, economic and institutional factors driving these threats; and opportunities to take actions against each threat.

2. BIODIVERSITY AND TROPICAL FORESTS IN GUATEMALA

2.1 GUATEMALA'S NATURAL FEATURES

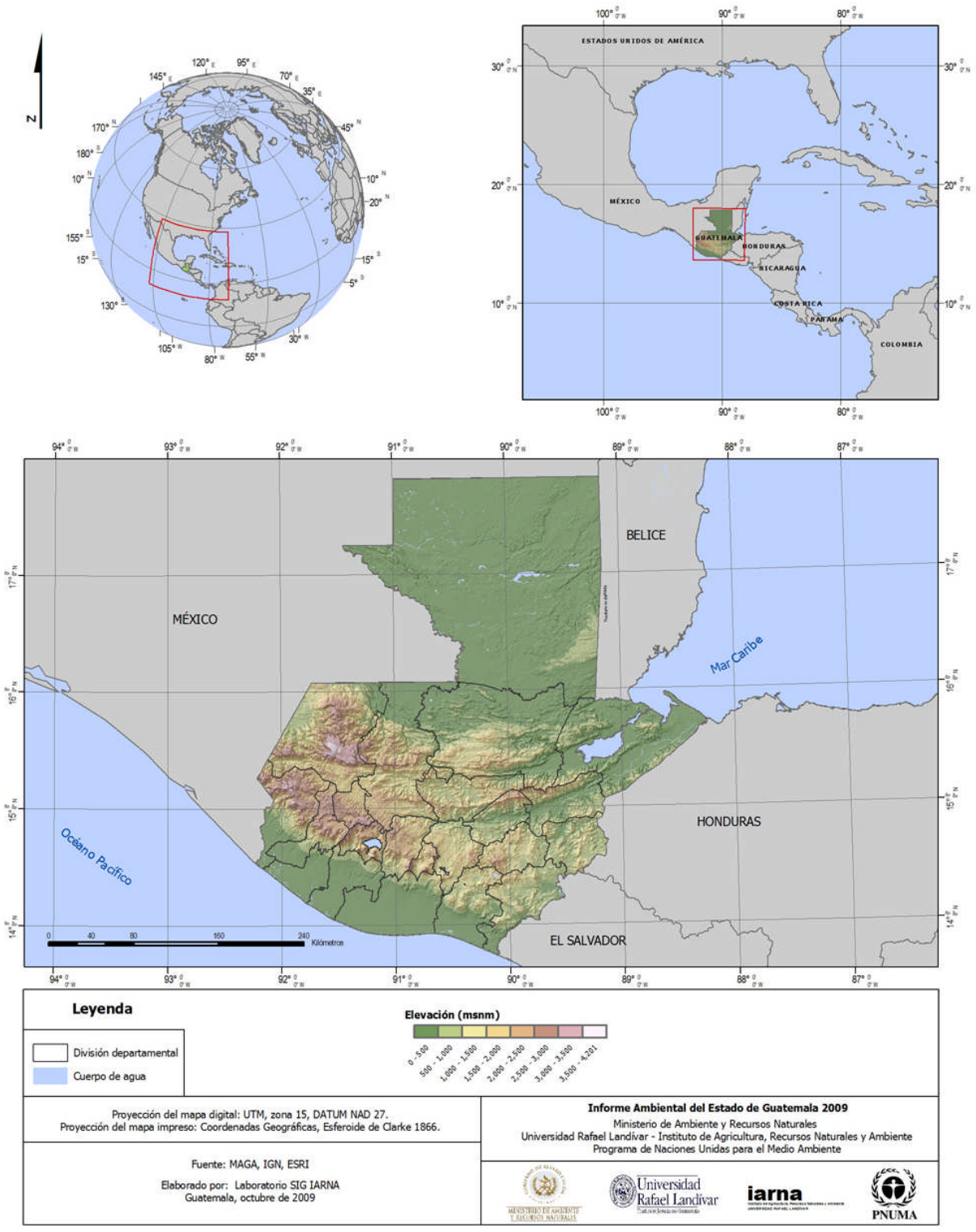
Guatemala is located in the Central American Isthmus and has borders to the north with the Yucatan Peninsula, Belize and the Caribbean Sea, to the south with the Pacific Ocean, to the east with Honduras and El Salvador, and to the west with Mexico (Figure 2.1). It has an area of 108,889 square kilometers (km^2) and is part of the bridge that links the Neartic region to the Neotropic region.

The country's topography varies greatly due to the Sierra Madre Mountains that divide into two large branches, one that goes through the central highlands and another that becomes the Sierra de los Cuchumatanes, the highest mountain chain in Central America. Other important features of Guatemala are the 37 volcanoes that give the country a wide variety of altitudes, extending from sea level to 4,220 meters (m). The volcanoes and Sierra de los Cuchumatanes have been identified as areas of high endemism, making the country part of the second most important biodiversity hotspot of the world for its biological richness, endemism, and endangerment (Myers et al. 2000).

Guatemala's position between the Caribbean Sea and the Pacific Oceans contributes to the country's marine ecosystem and species diversity and includes part of the Mesoamerican Coral Reef, sea grass areas, sea turtle nesting beaches and manatee brackish water habitats in the Caribbean Sea. The country's waters in the Pacific Ocean include 37 benthic habitats, with one very distinct sea depression located in the eastern side of the coast, identified as a preferred habitat of sharks, sea turtles and commercially important fish species (CONAP 2009).

The geographic position between two large areas of land and between two oceans, the many microclimates that originate from having many altitudes in small areas combined with an average temperature of 24°C, and an annual precipitation of 500 mm to 6,000 mm all contribute to the richness of the country in terms of biodiversity. A total of 10 physiographic regions, 7 biomes, 14 ecoregions, 66 ecosystems, and 14 life zones have been identified in the country and the list of new species for the country and for the world is growing constantly (CONAP 2008).

Figure 2.1: Guatemala's geographic location



2.2 ECOREGIONAL DIVERSITY

The first physiographic classification of Guatemala done in 1948 identified seven distinct regions. The National Geographic Society reviewed the classification in 1960 and added three more categories to produce the following physiographic characterization: Piedmont Volcanic Lands, Volcanic Highlands, Crystalline Highlands, Motagua Lowlands, Sedimentary Highlands, Izabal Lowlands, Internal Petén Lowlands, Lacandon Belt, and Mayan Mountains. The regions have been sub-categorized in 14 ecoregions and each one of these is organized in ecosystems. The geographic distribution of the ecoregions is presented in Figure 2.2 and a brief description is presented in Table 2.1 (Olson 2001).

Of the 14 ecoregions found in Guatemala, the most extensive is the Petén-Veracruz Humid Forests and it is considered to be the northern boundary for tropical vegetation. The southern boundary of North American temperate vegetation is the Pine-Oak Central American Forest, an area that has also high rates of bird endemism, is an important migratory route and is also the habitat of birds and insects that migrate between high and low altitudes.

The Central American Atlantic Humid Forests are part of the most important migratory route for birds that travel to and from North and South America. The Central American Montane Forests can only be found in patches that have become isolated, and although they are a priority in the country's conservation agenda, they face new threats every day. They are the habitat of unique endemic species such as the horned guan (*Oreophasis derbianus*) and Guatemala's national bird, the resplendent quetzal (*Pharomacrus moccino*).

Figure 2.2: Ecoregions of Guatemala

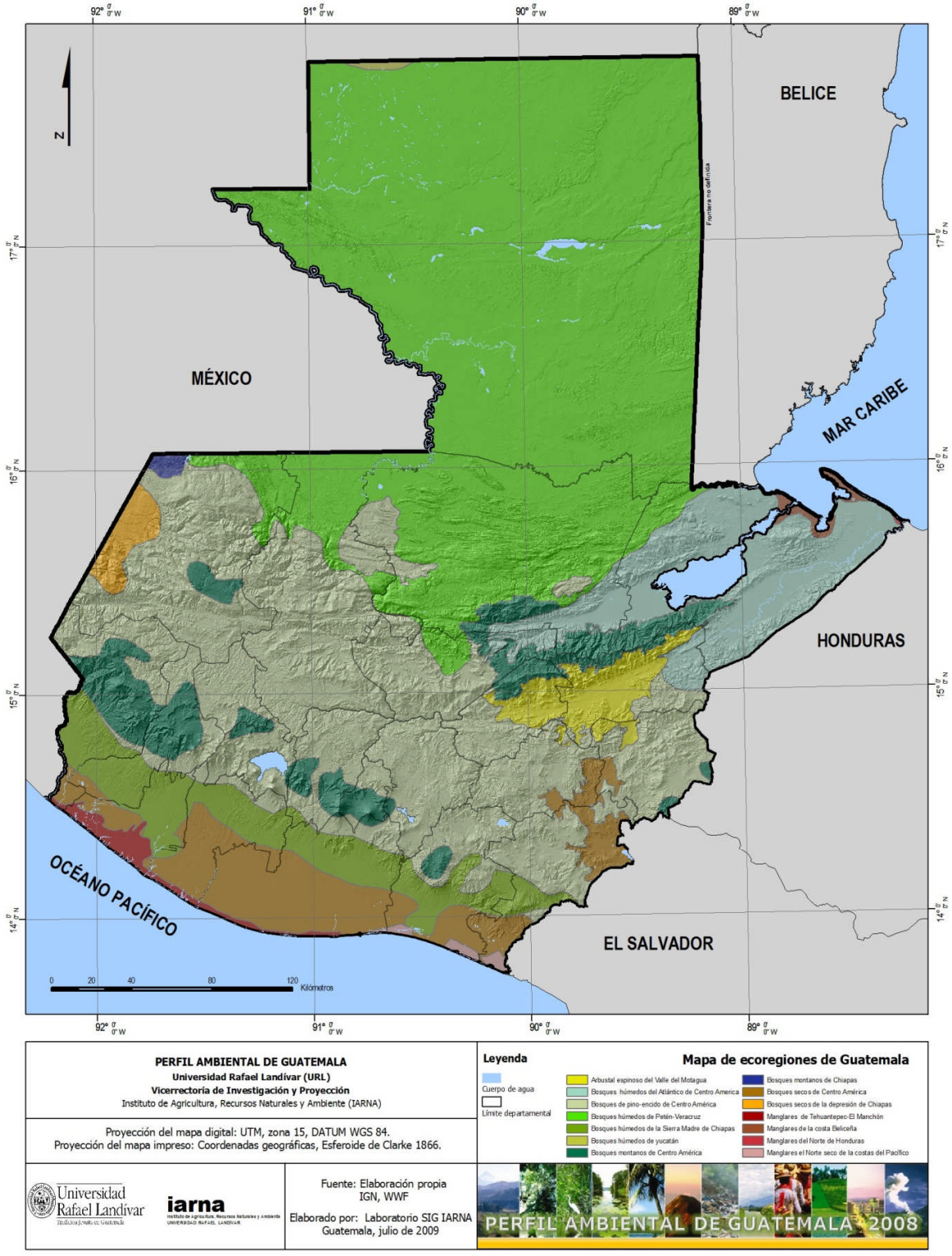


Table 2.1: Synthesis of Guatemala's Ecoregions (CONAP 2008)

Ecoregion	Description	Area (Km²)
Central American Atlantic Humid Forest	Tropical and subtropical humid broadleaf forests; they are part of the northern limestone highlands, the northern flooded plains and metamorphic lands.	7,800
Cental American Montane Forests	Tropical and subtropical humid broadleaf forests; they are part of the volcanic highlands, northern limestone highlands, metamorphic lands and piedmont volcanic lands.	5,670
Chiapas Montane Forests	Tropical and subtropical humid broadleaf forests in limestone highlands.	201
Petén-Veracruz Humid forests	Tropical and subtropical humid broadleaf forests in northern limestone lowlands and northern highlands	47,876
Sierra Madre of Chiapas Humid Forests	Tropical and subtropical humid broadleaf forests in the Pacific coastal plains, piedmont volcanic lands. Considered one of the most biodiverse ecoregions on Earth.	5,680
Yucatan Humid Forests	Tropical and subtropical humid broadleaf forests in northern limestone lowlands	166
Central American Dry Forests	Tropical and subtropical dry forests in volcanic highlands, Pacific coastal plains and piedmont volcanic lands	6,520
Chiapas Depression Dry Forests	Tropical and subtropical dry broadleaf forests in northern limestone highlands	910
Central American Pine-Oak Forests	Tropical and subtropical pine-oak forests in volcanic highlands, northern limestone highlands, northern limestone lowlands, metamorphic lands and piedmont volcanic lands	29,195
Motagua Valley Thornshrub	Desert and xeric shrub flora in metamorphic lands. It is considered the driest area of Central America, found only in Guatemala.	2,323
Mangroves of the Belizean Coast	Mangroves in northern flooded plains. With direct interaction with the Mesoamerican Coral Reef	385
Mangroves of the Dry Forests of the Pacific Coast	Mangroves in Pacific coastal plains	150
Tehuantepec-El Manchon Mangroves	Mangroves in Pacific coastal plains. Highest mangroves in Guatemala	853
Northern Honduras Mangroves	Mangroves in northern flooded plains	23

2.3 ECOSYSTEM DIVERSITY

Ecosystems in Guatemala have been characterized using many different methods. Perhaps the two most frequently used classifications are the Thornthwait climatic model, which is based on temperature and precipitation gradients and distinguishes 13 climatic zones; and the classification done by the National Forest Institute (INAB) which identifies 66 types of ecosystems – 41 natural and 25 that have been intervened by human activities (Table 2.2).

The ecosystem with the greater area is Productive Systems with Significant Natural Forest Patches dominated by broadleaf species (category 4-01 in chart 3). Other ecosystems with significant cover are the lowlands dense humid broadleaf forests (category 1-15 in chart 3), the productive systems with significant natural mixed forests (category 4-02 in chart 3) and the very humid hill broadleaf forests (category 1-19 in chart 3). The remaining 62 ecosystems cover less than the 5% of the country's territory (FIPA 2002).

An analysis of ecosystems in terms of the political division of the country shows that the department with the highest number of ecosystems is Izabal with 34, followed by Alta Verapaz and Huehuetenango with 29, and Petén with 27. El Progreso and Jutiapa both have 26 and Quiche and San Marcos each has 25 different ecosystems.

Table 2.2: Ecosystems of Guatemala

Code INAB	Ecosystem	Area Km^2	%
I – FORESTS		52,906.91	48.47
FORESTS WITH FLOODED SOILS		3,087.86	2.83
No Significant Salt Influence		2,727.89	2.50
1-01	Upland and lowland flood forests	151.89	0.14
1-02	Tall dense inundated forests (rainy season only)	1,673.47	1.53
1-03	Tall sparse inundated forests	73.56	0.07
1-04	Low inundated forests	828.97	0.76
Significant salt influence		359.97	0.33
1-05	Pacific Mangroves	359.97	0.33
FORESTS WITH WELL DRAINED SOILS		49,819.05	45.64
Deciduous forests		268.16	0.25
1-07	Xerophytic deciduous forests	135.36	0.12
1-08	Deciduous forest	132.80	0.12
Semi-deciduous forests of lowlands and		248.65	0.23
1-09	Broad-leafed semi-deciduous forests	200.26	0.18
1-10	Mixted semi-deciduous forests	48.39	0.04
Sub-montane semi-deciduous forests		1,333.09	1.22
1-11	Broad-leafed semi-deciduous forests	582.40	0.53
1-12	Mixed semi-deciduous forests	750.69	0.69
Montane semi-deciduous forests (poorly developed)		920.12	0.84
1-13	Broad-leafed semi-deciduous forests	284.40	0.26
1-14	Mixed semi-deciduous forests	635.72	0.58
Evergreen and semi-evergreen forests of lowlands and hills		25,538.36	23.40
1-15	Human dense lowland broad-leaf forests	11,564.27	10.59
1-16	Open humid lowland broad-leaf forests with wetlands	119.26	0.11
1-17	Humid broad-leaf hill forests	2,654.99	2.43
1-18	Very humid lowland broad-leaf forests	4,434.56	4.06
1-19	Very humid broad-leaf hill forests	6,576.18	6.02
1-20	Mixed pine forests	135.03	0.12
1-21	Conifer forests	54.07	0.05
Semi-evergreen submontane forests		5,085.80	4.66
1-22	Humid broad-leaf forests	172.38	0.16
1-23	Very humid broad-leaf forests	3,938.55	3.61
1-24	Mixed forests	888.54	0.81
1-25	Conifer forests	86.33	0.08
Semi-evergreen montane and semi-evergreen forests (lower quality)		4,179.70	3.83
1-26	Broad-leaf forests	1,416.67	1.30

Code INAB	Ecosystem	Area Km^2	%
1-27	Mixed pine forests	2,473.01	2.27
1-28	Pine forests	290.02	0.27
Evergreen montane and semi-evergreen forests (superior quality)		6,287.73	5.76
1-29	Broad-leaf forests	803.85	0.74
1-30	Mixed pine forests	4,319.09	3.96
1-31	Conifer forests	1,164.79	1.07
Evergreen upper montane and semi-evergreen forests		5,957.44	5.46
1-32	Broad-leaf forests	631.06	0.58
1-33	Mixed pine forests	3,036.21	2.78
1-34	Conifer forests	2,290.17	2.10
II – SHRUBS		10,901.47	9.99
2-01	Shrub wetlands dominated by reeds and scattered trees	368.93	0.34
2-02	Shrub wetlands not dominated by reeds and scattered trees	1,104.13	1.01
2-03	Upper montane shrub climax	170.57	0.16
2-04	Xeriphytic deciduous shrub	315.27	0.29
2-05	Non-xeriphytic deciduous shrub	2,222.27	2.04
2-06	Other broad-leaf shrubs	5,144.45	4.71
2-07	Other mixed and coniferous shrubs	1,575.85	1.44
III – PASTURES AND SAVANNAHS		1,730.35	1.59
3-01	Herbaceous wetlands	192.85	0.18
3-02	Herbaceous wetlands with palms or shrubs	375.36	0.34
3-03	Pioneer communities in Sandy openings	320.44	0.29
3-04	Deforested montane herbaceous or shrubs	841.70	0.77
IV- AGRICULTURE SYSTEMS AND FOREST PLANTATIONS		41,837.20	38.33
PRODUCTIVE SYSTEMS WITH SIGNIFICANT FOREST FRAGMENTS		31,954.73	29.28
4-01	Dominated by broad-leafs	15,266.29	13.99
4-02	Dominated by mixed plants	7,086.50	6.49
4-03	Dominated by conifers	496.94	0.46
4-04	Dominated by pastures and shrubs	2,488.76	2.28
4-05	Dominated by shrubs and pastures	2,478.85	2.27
4-06	Dominated by broad-leafs and coffee and/or cacao and/or cardamon	608.62	0.56
4-07	Dominated by broad-leafs and coffee and/or cacao and/or cardamon	3,528.77	3.23
PRODUCTIVE SYSTMES WITH NON SIGNIFICANT FOREST FRAGMENTS		9,882.47	9.05
Monocultures		7,734.82	7.09
4-08	Banana	217.49	0.20
4-09	African Palm	104.64	0.10
4-10	Rubber	178.95	0.16
4-11	Sugar Cane	3,670.30	3.36
4-12	Melon	49.93	0.05
4-13	Diverse monocultures	3,513.51	3.22
4-14	Livestock pastures	1,914.37	1.75

Code INAB	Ecosystem	Area Km^2	%
4-15	Forest Plantations	233.28	0.21
V- WATER		1,373.68	1.26
5-01	Lakes (greater than 10 km^2)	902.62	0.83
5-02	Lakes (less than 10 km^2) and rivers	221.87	0.20
5-03	Rivers	249.19	0.23
VI- OTHER		401.74	0.37
6-01	Non-vegetated areas (sand, rock)	59.57	0.05
6-02	Urban areas	245.83	0.23
6-03	Farms and aquaculture and/or salt pans	11.21	0.01
6-04	Non-interpreted areas	85.13	0.08
TOTAL		109,151.35	100.00

Source: Jolon-Morales 2006

2.4 FRESH AND BRACKISH WATER RESOURCES

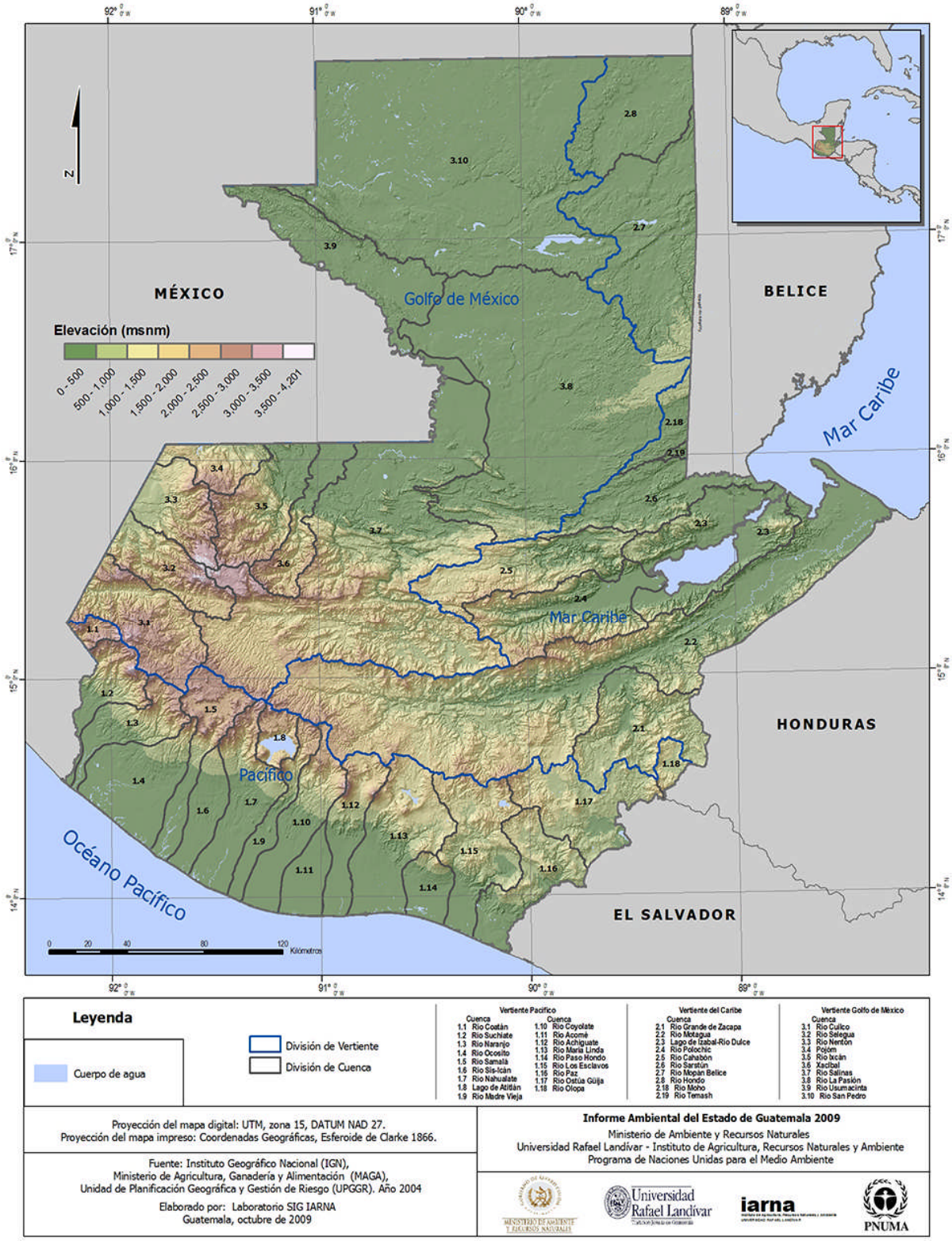
Thirty-eight principal watersheds drain to the Pacific Ocean, the Caribbean Sea, and the Gulf of Mexico in the Atlantic Ocean (Figure 2.3). Most basins are narrow and very steep in the highest parts. The ones that drain to the Pacific extend through the volcanic chain and drain into the coastal plains before getting to the ocean. They typically have high sediment levels due to the presence of the active volcanoes. The basins that drain into the Atlantic descend from very steep headwaters into large rivers and broad floodplains before reaching the sea. Table 2.3 summarizes the areas and flows of the principal drainage areas in Guatemala.

Table 2.3: Major Drainage Areas of Guatemala

Slope	Area (Km^2)	% country area	Number of basins	Average Flow m^3/ second
Pacific	23,990	22	18	393
Caribbean	34,259	31	10	628
Gulf of Mexico	50,640	47	10	1,672
TOTAL	108,889	100	38	2,693

There are 7 lakes, 49 freshwater lagoons, 19 brackish water lagoons, and 109 smaller lagoons in the country (PREPAC 2005).

Figure 2.3: Water Basins in Guatemala



2.5 CHANGES IN FOREST COVER

The study of forest dynamics conducted by Universidad del Valle of Guatemala (UVG), National Forest Institute and National Protected Areas Council in 2006 showed the deforestation rates by ecoregion (Table 2.4).

The Central America Dry Forest shows the highest deforestation rate and the smallest area. If deforestation continues at this rate it is predicted that the ecoregion will be completely lost in Guatemala by the year 2031. The Motagua Valley Thornshrub, which is also experiencing very high rates of degradation and loss, could also disappear in Guatemala by approximately 2037 unless actions are taken to stem this trend (IARNA 2009).

The Petén-Veracruz Humid Forest represents the ecosystem that has experienced the most extensive loss of area, with an estimated 396,000 hectares (ha) lost during the 10-year period covered in the analysis. The only ecoregion in Guatemala that expanded its forest cover during this period was the Tehuantepec-El Manchon Mangrove ecosystem, which observed an approximate increase of about 37 ha/year.

Table 2.4: Forest cover loss and deforestation rate in ecoregions

Ecoregion	Area		Area with Forest (%)		Net Loss 1991-2001 (ha)	Deforestation Rate1991-2001 (%)
	Hectares	%	1991	2001		
Motagua Valley Thornshrub	234,409	2.15	19.2	15.0	9,741	21.7
Central American Atlantic Humid Forests	781,567	7.18	40.1	34.7	41,815	13.4
Central American Pine-Oak Forests	2,951,563	27.11	36.7	33.8	85,649	7.9
Chiapas Sierra Madre Humid Forests	577,105	5.30	14.2	13.2	5,770	7.1
Petén-Veracruz Humid Forests	4,808,127	44.16	66.6	58.4	395,962	12.4
Yucatán Humid Forests	12,139	0.11	67.6	67.4	29	0.4
Central American Montane Forests	598,418	5.50	50.3	48.0	13,471	4.5
Chiapas Montane Forests	18,737	0.17	36.0	30.5	1,032	15.3
Central American Dry Forests	664,646	6.10	3.1	2.3	5,112	24.7
Chiapas Depression Dry Forests	89,938	0.83	21.0	17.8	2,847	15.1
Mangroves of the Coast of Belize	35,615	0.33	67.5	63.3	1,502	6.2
Tehuantepec-El Manchón Mangroves	88,229	0.81	12.7	13.2	-367	-3.3
North of Honduras Mangroves	1,966	0.02	52.1	42.5	189	18.4
Mangroves of the Dry Forest of the Pacific Coast	26,441	0.24	16.8	15.2	424	9.5
Total	10,888,900	100.00	47.0	41.9	563,176	11.0

Protected areas in Guatemala are also suffering dramatic losses of forest cover. Assessments of estimated forest cover losses for protected areas categories I and II can be seen in Table 2.5. The following table shows the eight areas with highest forest cover loss for the 10-year period 1991-2001 and the total loss for all areas in categories I and II.

Table 2.5: Changes in Forest Cover and Deforestation Rates in Selected Protected Areas Categories I and II

Protected Area	Total area (ha)	Forest cover (%)		Net Loss 1991-2001 (ha)	Annual net loss (ha)	Deforestation rate 1991-2001 (%)
		1991	2001			
Monumento Cultural Ceibal	1,504	97.5	69.3	424	42.4	29
Parque Nacional El Reformador	60	64.8	50.1	9	0.9	23
RB Montañas Mayas Chiquibul	61,686	87.3	68.8	11,439	1,143.9	21
Monumento Cultural Aguateca	1,702	93.6	73.8	338	33.8	21
Monumento Cultural Dos Pilas	3,115	95.5	78.7	524	52.4	18
Monumento Cultural Quiriguá	33	50.4	42.2	3	0.3	16
Reserva Biológica San Román	18,742	96.1	85.2	2,053	205.3	11
Parque Nacional Laguna El Pino	500	49.6	44.6	25	2.5	10
Total for 39 selected protected áreas	1,116,764	86.0	82.5	40,027	4,002.7	4

2.6 RARE AND UNIQUE ECOSYSTEMS

WETLANDS

Wetlands in Guatemala include rivers, lakes, lagoons, swamps, coastal systems, caves, estuaries, creeks, flooded forests, flooded grasslands, and springs. The National Wetland Inventory identified 252 wetlands, seven of which have been declared international important wetlands by the International Wetland Convention (Mendez et al. 1999). The largest is Parque Nacional Laguna del Tigre in the Maya Biosphere Reserve in Peten (335,080 ha), followed by Refugio de Vida Silvestre Punta de Manabique in Izabal (132,900 ha), Manchon Guamuchal in San Marcos and Retalhuleu (13,500 ha), and Refugio de Vida Silvestre Bocas del Polochic in Izabal (21,227 ha).

Five of the existing six coastal marine wetlands are considered to be critically endangered: Punta de Manabique in Izabal, Manchon Guamuchal in San Marcos and Retalhuleu, Monterrico in Taxisco Santa Rosa, El Paraiso La Barrona in Jutiapa, and Sipacate-Naranjo in Escuintla. Sipacate-Naranjo is one of the few sites in the world where sea turtles enter the brackish water mangrove creeks from the sea.

MARINE ECOSYSTEMS

The geomorphic characteristics of the Atlantic and Pacific coasts in Guatemala vary greatly. The Atlantic (Gulf of Mexico and the Caribbean Sea) has shallow waters where marine pastures and coral reef thrive. Marine pastures have been documented as important feeding grounds for sea turtle nestlings, and the

coral patches found in Guatemala are part of the second most important coral reef in the world. The Mesoamerican Coral Reef, a system shared by Mexico, Belize, Guatemala, and Honduras, represents one of the most dynamic and important reef systems on earth, particularly due to the 35 species of corals that can be found.

The Pacific coastal and marine areas include 37 benthic habitats, with one very unique sea depression located in the eastern side of the coast. This sea depression extends several thousand meters in depth and has been identified as a preferred habitat of sharks, sea turtles and commercially important fish species (CONAP 2009). These very deep waters are dramatically distinct from the marine systems found in the Caribbean and serve as important areas for commercial fishing, sport hunting of marlin, and whale watching.

CAVES AND UNDERGROUND ECOSYSTEMS

Karst towers, dry sinkholes, water-filled sinkholes, hummocks, underground rivers, and cave systems are common in the Northern Limestone Highlands. Unfortunately, there is a paucity of information available to document the biodiversity of the Guatemalan cave ecosystems and these unique formations. However, Reddell's review of the cavernicole fauna in Mexico, Guatemala, and Belize highlights the importance of this region's biodiversity as one of the richest in the world based on the extensive cave systems found in varying habitat types (FIPA/USAID 2002).

OTHER ECOSYSTEMS

Some other areas that require attention due to important biodiversity features are the following (CONAP 2008):

a) Dry forests of Huehuetenango, Cimarron in particular, has several endemic flora species

b) Parts of San Mateo Ixtatan, Yalambojoch in particular, where there are small groups of highland howlers

c) The Pine *Pinus chapensis* communities in Barillas in Huehuetenango and Nebaj in Quiche

d) Wetlands in the Petén region

e) Karstic systems of Lanquin and Semuc Champey in las Verapaces

The Environmental Profile of Guatemala mentions the following ecosystems with limited distributions in Guatemala (IARNA 2006):

a) Flooded dense forests is limited to 151.89 km² in Bocas del Polochic, Izabal

b) Xerophitic deciduous forest, limited to 135.36 km² in Jutiapa and El Progreso

c) Low height pine forest with 54.7 km² in Poptun, Petén

d) Climax high montane shrub with 170.57 km² in Huehuetenango

e) Swamp grasslands limited to 192.85 km² in Parque Nacional Laguna del Tigre, Petén

2.7 FOREST TYPES AND FOREST COVER

Most of the terrestrial surface area in Guatemala is considered potential forest cover. The land capability map for the country indicates that approximately 5,305,279 ha of land are suitable for forests,

representing 48.7% of the country's territory (INAB 2000) (Figure 2.4). The most recent estimate of total area covered by forests is from 2003 and it added up to 4,276,308 ha (MAGA 2006) (Figure 2.5).

The analysis conducted by the Integrated Environmental and Economic Accounting System for the forests account concludes that between 1950 and 2003 Guatemala has lost 60.32% of forest cover (BANGUAT 2009) (Table 2.6)

Forests in Guatemala are classified as conifer forests, mixed forests, broadleaf forests and mangrove forests. Each type has a unique set of species that identifies them.

a) Conifer Forests: One or several pine species (*Pinus spp*), abies (*Abies guatemalensis*), cypress (*Cupressus lusitanica*), taxodium (*Taxodium mucronatum*) and juniperus (*Juniperus comitana*). There are 10 different pine species in Guatemala. These forests can be found in Huehuetenango, San Marcos, Quiche, Baja Verapaz, and Totonicapan.

b) Mixed Forests: Conifer and broadleaf species, with predominantly *Pinus* and *Quercus*, although some species from the Betulaceae family can be found (*Ostyra spp* and *Alnus spp*), Hamamelidaceae (*Liquidambar styraciflua*) and other genera from the Lauraceae family (*Ocotea spp, Nectandra spp, Persea spp*). These forests can be found in almost all the country but are predominant in Quiche, Huehuetenango, Alta Verapaz, Chiquimula, and Zacapa.

c) Broadleaf Forests: These are also referred to as tropical humid forest or jungles. In some areas like the Petén region they can have as many as 300 different flora species per hectare, including 50 species of trees. The largest areas are in the Petén but they can also be found in Alta Verapaz, Izabal, Quiche, and Huehuetenango.

d) Mangrove Forests: There are five species of mangroves in Guatemala (*Avicenia nitida, A. bicolor, Rizophora mangle, Laguncularia racemosa* and *Conocarpus spp*). Forests of this type can be found along the coastlines. The largest areas are in Retalhuleu, Santa Rosa, Escuintla, Jutiapa, Suchitepequez and San Marcos Departments.

Table 2.6: Millions of hectares of forest in Guatemala in 1950 and 2003

Type of Forest	1950 Millions of ha	2003 Millions of ha
Broadleaf	5,485,101	3,246,359
Mixed	1,005,173	649,187
Conifers	445,827	297,138
Mangroves	37,823	14,196
Total	6,973,923	4,206,880

Figure 2.4: Land Capability of Guatemala

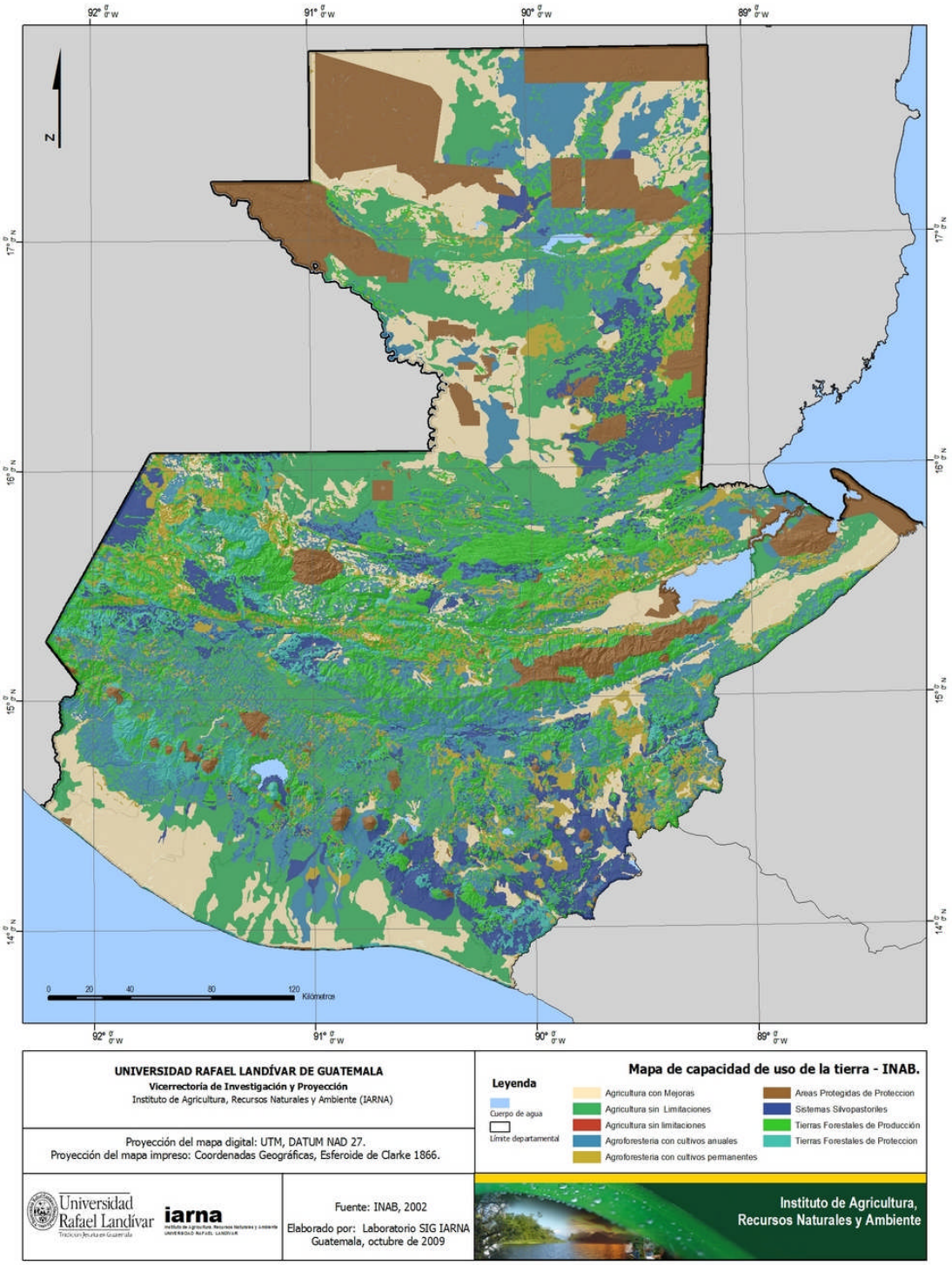
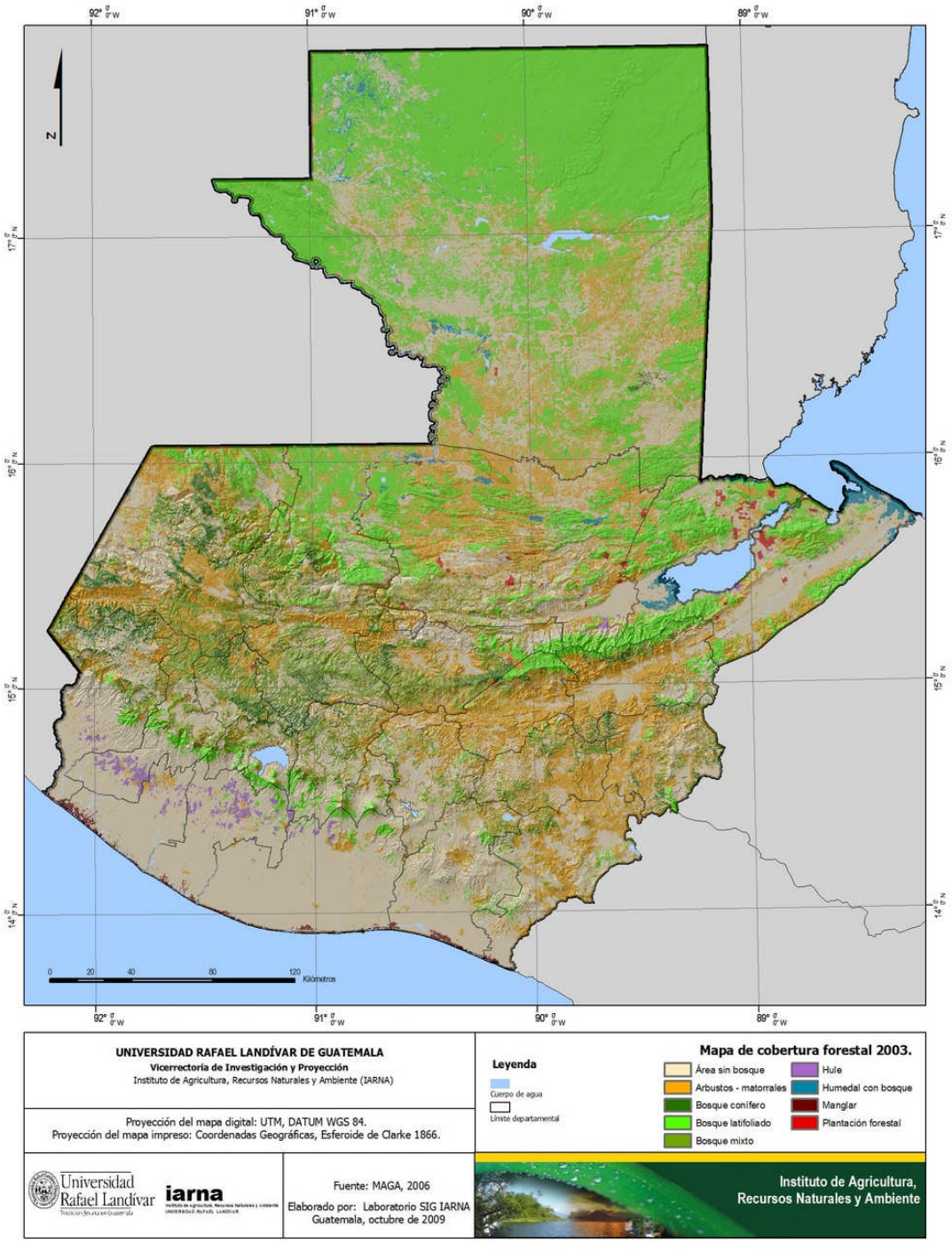


Figure 2.5: Forest Cover 2003



Guatemala's forests are important from both a biodiversity conservation and economic perspective. They play a key socio-economic role by providing essential environmental services (water recharge, carbon sequestration, mitigation of natural disasters, prevention of erosion) as well as a wide variety of products for the forest industry that are used to supply domestic and international markets.

The Departments with the highest rates of forest cover loss are by order of importance: Chiquimula, Jutiapa, Petén, Jalapa, Izabal, and Zacapa. The Departments that have gained forest cover are Sacatepequez and Retalhuleu. Approximately 65% of the deforestation in Guatemala occurs in the Petén region. About 61% occurs outside protected areas and 39% within protected areas with high pressures (Montañas Mayas, Laguna del Tigre, and Sierra del Lacandon National Parks) (IARNA 2006)

2.8 SPECIES DIVERSITY

2.8.1 FLORA

The most recent publication regarding plant diversity reports 10,364 species in 2,478 genera and 321 families (CONAP 2008). The same authors note that floristic research in Guatemala is still in an early development stage and that there is still a need to study the taxonomy, ecology, and distribution of groups such as mushrooms, lichens, hepatics, algae, and mosses.

Guatemala is one of eight world biodiversity and origin centers due to the complexity and diversity of plant formations (Vasquez 1999). There are 6,463 species of plants with flowers, 28 species of conifers, 637 species of ferns, 527 species of orchids, and 519 species of mosses (CONAP 2008).

2.8.2 FAUNA

The most recent count of vertebrate fauna reports 3,025 species, including 735 species of birds, 244 species of mammals, 143 species of amphibians, 243 species of reptiles, and 1,033 species of fish (IARNA 2009).

There are 12 orders and 33 families of mammals in Guatemala. The orders, in order of importance, are: Chiroptera (bats) with 109 species, Rodentia (mice) with 56 species, and Cetacea (dolphins, whales) with 26 species (Jolon-Morales 2006).

Reptiles are represented in Guatemala mainly by the families Colubridae (with over 100 species), Polchrotidae, and Phrynosomatidae. Together they group 57% of the total species reported for the country. Amphibians in Guatemala are represented mainly by the families Plethodontidae, Hyllidae, and Leptodactylidae which together hold over 80% of the species reported for the country.

Fish species in Guatemala are grouped in 459 genera, 155 families, 43 orders, and two classes (CONAP 2008)

2.8.3 THREATENED AND ENDANGERED SPECIES

Guatemala includes 1,234 species of animals included in the most recent red list. One species is considered extinct, 39 are critically endangered. Forty-nine species are endangered and 57 are vulnerable. The flora list includes 1106 species – 252 species of trees and 854 species of non-timber flora.

According to the list of endangered species published by CONAP, there was an increase of 1.3% listed plant species from 1999-2006. The fauna section of the list increased 1.6 % in the same period (IARNA 2009).

2.8.4 RARE AND UNIQUE SPECIES

The Environmental Profile of Guatemala gives the following numbers of endemic species per taxonomic group:

a) 146 species of plants

b) one species of birds

c) three species of mammals

d) 45 species of amphibians

e) 25 species of reptiles

f) 17 species of fish

g) 197 species of insects

Thirty-four species of birds have restricted distributions to the Central American Highlands (22 species), the Pacific lowlands (3 species), and the Yucatan Peninsula (22). The criterion that applies for endemism in other groups differs for this group.

2.8.5 MIGRATORY SPECIES

Of the total list of 735 bird species that can be found in Guatemala, 206 are migratory. The analysis on the origin of species showed that 163 are originally from North America, 256 are from South America, and only 30 have a Mesoamerican origin (Eisermann and Avendano 2006). There are 233 species that have wider distributions, from North to South America and from South America to northern Mexico.

Other important migratory species include five species of marine turtles that nest both in Caribbean and Pacific beaches (*Lepidochelys olivacea, Chelonia mydas, Caretta caretta, Dermochelys coriacea, and Eretmochelys imbricata*).

Specimens of the Florida Manatee come to the Caribbean coast and into the estuarine system of Rio Dulce in Izabal, with reports for both adults and calves. Hunting of these mammals has been reduced due to a protection and conservation strategy implemented in 2004.

Guatemala is visited by 27 species of dolphins and whales, including humpback whales that mate in waters close to the Pacific coastline. There is a growing tourism activity based on whale watching in the country.

2.9 GENETIC DIVERSITY

Guatemala is the center of origin of several food species such as corn, beans, yucca, cotton, and peppers and genetic combination between domesticated and wild species is highly probable. Corn is very important in Guatemala because it is widely used in the everyday diet and 13 of the 14 species reported for Central America can be found in the country (Azurdia 2004). Beans are also part of the basic diet of Guatemalans and 12 species of the genus *Phaseolus* can be found in the country. Most of the populations of these species are from highlands between the Pacaya and Agua Volcanoes.

3. BIODIVERSITY CONSERVATION EFFORTS IN GUATEMALA

Biodiversity conservation depends on both *ex situ* and *in situ* conservation measures. *Ex situ* conservation is the process of protecting a species of plant or animal by removing all or part of the population from a threatened habitat and placing it in a secure location, which could be a wild area or within the care of humans. *In situ* conservation involves sustaining species undisturbed in their native habitat. In Guatemala, *ex situ* biodiversity conservation is carried out through two seed banks, five zoos, 14 fauna breeding facilities, one faunal rescue center, one botanical garden, 57 breeding grounds for ornamental flora, 21 breeding grounds for forest species of different use, four herbaria, two natural history museums, two insectaries, two living reptile collections, two arboreta, 64 private collections of fauna, and various field plantations (CONAP 2006). The different species collections are administrated by public and private organizations, including universities, NGOs, governmental organizations, and private collectors. *In situ* conservation methods include the legal protection of large natural areas in different categories, such as national parks, wildlife refuges, private protected areas, and biosphere reserves, among others.

In Guatemala *in situ* and *ex situ* biodiversity and tropical forest conservation are principally carried out under the jurisdiction of the Ministry of Environmental and Natural Resources, and the associated National Council for Protected Areas, along with the National Forest Institute and the Ministry of Agriculture (MAGA,) administered by a multitude of agencies within the Government of Guatemala, including the five Authorities of River Basins from the River Pensativo, Lake Izabal-Río Dulce, Lake Amatitlán, Lake Atitlán and Lake Petén Itzá, all of which plan, coordinate and execute management actions in their respective river basins with the participation of local stakeholders.

Several sub-national and civil society efforts also figure prominently in the conservation of biodiversity and tropical forests, particularly the community organizations managing large areas of state allocated forest concessions in the Petén region, and the consortium of private nature reserves that have been set up throughout the country. A review of the missions, responsibilities, and limitations of these groups will establish the institutional framework in which conservation occurs in Guatemala.

3.1 NATIONAL INITIATIVES

Responsibilities for the administration, management and technical delivery of biodiversity and forest conservation initiatives are distributed within several national and municipal government agencies. This has resulted in problems with overlap of responsibilities in some cases, and uncertainty over jurisdiction in others. However, three government agencies assume the bulk of responsibilities – the MARN, CONAP, and INAB. In the private sector, the forest industry plays a significant role in the development and state of the country's forest ecosystems. A wide diversity of non-governmental and civil society organizations include biodiversity and forest conservation in their missions, and public and private universities and research centers also contribute significantly to the national dialogue and conservation response. The following section examines some of the principle responsibilities and roles each of these institutions now fill. Section 5 of this report examines opportunities to support and, where appropriate, strengthen these institutional efforts.

3.1.1 MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES

The Ministry of Environment and Natural Resources was created by Government Agreement No. 186-2001 and Reforms to the Executive Body Law on November 30, 2000, in which Article 3 added the MARN as the ministerial body responsible for "formulating and executing policies related to its field: complying and ensuring compliance of the regime for conservation, protection, sustainability and environmental improvement, and the country's natural resources, and citizens' rights to a healthy environment; and a reduction in environmental degradation and the loss of natural patrimony."

Most of the MARN's mandated responsibilities as described in Article 3 pertain to the development and administration of policies that guide other government and civil society groups engaged in environmental management, with particular attention to coordinating the monitoring and enforcement of national policies among a complex association of government and non-governmental bodies. For example, the review and processing of Environmental Impact Assessments (EIAs) has occupied a central focus of the MARN in line with its regulatory responsibilities, and an Office for Enforcement is responsible for receiving and responding to reports of environmental crimes. The enforcement responsibilities require extensive coordination with other governmental agencies to process and respond to reported crimes. However, as is the case with other offices within the MARN, the Office for Enforcement has very limited human resources and infrastructure with which to respond to an enormous national problem of illicit timber sales, wildlife trafficking and other abuses.

The MARN works collaboratively with other government and particularly with civil society organizations to respond to the following priority concerns:

- Climate change adaptation and mitigation
- Integrated management of watersheds and hydrologic resources
- Strengthening and expansion of the Guatemalan System of Protected Areas (SIGAP)
- Support for the development of renewable energy programs
- Strengthening of national bioethics in all programs.

Unfortunately, the weight of responsibilities assigned to the MARN has not included the budget allocations, human resources or infrastructure required to fully achieve its ambitious mandates. The MARN remains one of the smallest ministries in Guatemala in terms of personnel and budget, and recent allocations have amounted to less than 1% of the total annual GoG budget. The proposed 2010 GoG allocation proposes additional reductions in this already limited budget, which could further challenge an agency that continues to operate without the resources necessary to implement its medium- and short-term vision, plans, and agendas.

3.1.2 THE NATIONAL COUNCIL FOR PROTECTED AREAS

The government entity that has the closest relationship with the MARN is the National Council for Protected Areas, which develops and executes environmental conservation and protection action plans. CONAP is also the government organization legally in charge of the management and coordination of the National Protected Area System and biodiversity of the country, mandated under the Guatemala Protected Area Law (Legislative Decree 4-89, modified in Legislative Decree 110-96). The SIGAP is the principal mechanism through which *in situ* conservation is carried out in Guatemala. The SIGAP now includes more than 180 protected areas, which cumulatively comprise more than 36,000 km^2 (Triana 2009). This extension constitutes approximately 33% of the national territory. The SIGAP's objectives are to conserve biodiversity and to protect representative samples of the country's ecosystems, chosen for their biological richness or for the environmental goods and services they generate.

CONAP has delegated the co-administration of protected areas to six NGOs, 14 Municipalities, and five other governmental organizations. *In situ* conservation methods being applied through CONAP in Guatemala include three biological corridor initiatives, seven wetlands listed in the RAMSAR Convention, and the promotion of habitat enhancement practices within various traditional agriculture and agroforestry systems (CONAP 2006).

However, despite the strong conservation agenda articulated for Guatemala, there are some institutional limitations that could constrain the outcomes of conservation efforts. For example, the SIGAP has significant ecological gaps in terrestrial, freshwater, and marine ecosystems (Table 3.1). Only one non-terrestrial area has been designated – the Refugio de Vida Silvestre Punta de Manabique. There is also a need to more fully engage local and indigenous communities, and improve the sharing of benefits associated with protected areas. Other significant constraints include insufficient budgets to carry out mandates; incomplete data to support planning and decision-making; insufficient and poorly trained personnel to implement management needs; insufficient equipment and infrastructure to carry out research activities; and limited personnel and infrastructure resources to support stakeholder collaboration; and therefore, limited resources to effectively formulate and carry out national conservation planning. Another challenge faced by CONAP and the SIGAP is a general lack of political and public support, which translates into a lack of necessary financial resources to support management mandates.

Table 3.1 Percent of Guatemala Ecoregions Represented in SIGAP

Ecoregion	Area Protected within SIGAP (km^2)	% of Total Ecoregion
Motagua Valley Thornshrub	461.0	19.7
Central American Atlantic Humid Forest	1,728.0	22.1
Central American Pine-Oak Forests	2,340.6	7.9
Sierra Madre-Chiapas Humid Forests	71.5	1.2
Petén-Veracruz Humid Forests	25,623.5	53.3
Yucatan Humid Forests	113.6	93.6
Central American Montane Forests	2,507.8	41.9
Chiapas Montane Forests	0.0	0.0
Central American Dry Forests	214.0	3.2
Chiapas Depression Dry Forests	0.0	0.0
Mangroves of the Belizean Coast	285.9	80.3
Tehuantepec-El Manchon Mangroves	46.0	5.2
Northern Honduras Mangroves	18.4	93.7
Pacific Coast Dry Forest Mangroves	0.0	0.0

Source: CONAP 2008

A new mechanism of incentives for utilization, management, and conservation of Guatemala's biodiversity was proposed in 2008 based on a modification of the current National Conservation Fund (FONACON) which is under the CONAP umbrella. Under the FONACON, biodiversity conservation would be supported through economic incentives to institutions in charge of biodiversity conservation projects as well as those that offer environmental services. Monetary sources would be derived from allocated government funds, funds collected through service agreements and payments negotiated by CONAP, and international cooperation. Development of institutional capacities and a plan of action have been proposed (CONAP 2006).

3.1.3 THE NATIONAL FOREST INSTITUTE

Guatemala's National Forest Institute was established as an autonomous organization in 1996 with a board composed of the multiple stakeholders identified in the national Forestry Action Planning process. Only two of the seven board members are from the executive arm of the state. Others are representatives of the private sector, NGOs, the Forestry School, the National Association of Municipalities, and universities. INAB's manager is elected by the board rather than being nominated by the President, Minister of Agriculture or other government officials. The operating mission of INAB focuses on sustainable development of the nation's forest resources, taking into account ecological and social factors. Forest conservation has become an increasingly central concern in recent years, and the agency maintains a relatively transparent internal structure. INAB suffers from inadequate human resources, equipment, and capacity, particularly in the more remote areas of Guatemala where most of the remaining intact forests remain. The agency serves as the lead institution in the implementation of Guatemala's National Forest Program, within which the Program for Forestry Incentives (PINFOR) and the small stakeholder incentives program (PINPEP) have emerged.

3.1.3.1 THE NATIONAL FOREST PROGRAM:

Guatemala's National Forest Program (NFP) was formed in 1989 under the name "Forest Action Plan for Guatemala" to respond to forest management needs in all three ownership sectors, and has continued since 2003 under the title "National Forest Program." In the mid-1990s, relations in the forestry sector between the Government, private-sector timber firms, and civil-society organizations were such that collaboration was non-existent. However, in recent years a more collaborative forestry program has emerged through greater engagement of a wider spectrum of national stakeholders. Institutions facilitating the process include the Ministry of Agriculture, Livestock and Food; MARN; CONAP; and the INAB. The process gained input from individual and institutional advisers, expert and regional consultative bodies, and a Forest Action Plan implementation office (Hurtarte et al. 2006).

One outcome from this process was a significant revision of the Forest Action Plan for Guatemala in late 2002 and early 2003. Revision of the Forest Action Plan for Guatemala focused on analyzing and developing strategic objectives for four main areas of the forest sector: Forest Conservation and Protection, Production and Sustainable Management, Trade and Industry, and Environmental Services. New strategic objectives were also developed for Institution Building as a cross-sector support area. The strategic objectives were used to develop an action plan adopted and implemented as the National Forest Agenda for 2003–2012.

In support of this new national agenda, INAB entered into a three-year cooperative agreement with the Netherlands in December 2003 to implement an institution-building strategy, including a component to support improved dialogue among institutions and stakeholders. The agreement responded to the increasing demand, particularly from representatives of the forest industry, for greater participation of interest groups and national clarity on the legal and administrative mechanisms to be used to manage public forests. The agreement specifically aimed to promote the following changes in the forest sector:

- De-centralization and improved accountability in decision-making
- Enhanced participatory dialogue by a broader spectrum of forest stakeholders, particularly incorporating local civil society groups
- Recognition of traditional cultural practices in forest management
- Improved mechanisms and incentives to ensure accountability of public management to society
- Policies to ensure continuity in agreed long-term policies and strategies and in trained technical staff

- Measures to strengthen the enforcement of legislation and forest regulations

Another outgrowth of the national forest agenda revisions has been improved relations between locally-based private forest-sector interest groups and national and regional authorities. Formal agreements between these local and national entities have led to the creation and strengthening of regional Forest Policy Round Tables (Mesas de Concertación y Política Forestal). The Forest Policy Round Tables now serve as autonomous mechanisms for sub-national dialogue, and engage about 30 organizations or groups, including the central government, local authorities, NGOs, civil-society bodies, and private companies involved in the production, conservation, protection, and use of forest resources. Their aim is to promote socio-economic development through activities in line with national forest policy and to find solutions to problems affecting the sector within the framework of regional forest agendas. Round tables have since been set up in each of nine forest regions defined by INAB.

However, national and regional forest stakeholders continue to voice a series of issues that continue to act as constraints to the implementation of the NFP and regional and local forest industry operatives (Hurtarte et al. 2006):

- Training opportunities for all forest sector stakeholders in order to strengthen the dialogue and outcomes from Forest Policy Round Tables
- Training opportunities for forest industry operatives to improve forest management practices
- Establish the Forest Policy Round Tables as lead forest agencies in the nine regions
- Promote a "forest culture" that accounts for social, economic, and ethnic diversity and different interests of the various stakeholders, and provides mechanisms for all stakeholders to contribute to the development and implementation of sustainable forest and watershed management practices.

3.1.5 NATIONAL AND INTERNATIONAL CONVENTIONS, TREATIES, AND POLICIES

Guatemala signed the Convention on Biological Diversity in 1993, and has also signed the CITES, the RAMSAR Convention on Wetlands, and the Kyoto protocol to mitigate the impact of GHG emissions on the global climate.

The principal national legal mechanism supporting the management and conservation of biodiversity in Guatemala is the 1989 Protected Area Law (Decreto 4-89) and its revisions. The Protected Area Law is generally compatible with other important biodiversity and forest conservation laws and policies in Guatemala, including the national Forest Management Law; the law for conservation of Natural and Cultural Patrimony; and the organic law creating the Ministry of Environment. However, other policies such as the Mining and Hydrocarbon Law, and the Fisheries Act do result in some conflict due to the promotion of resource exploitation in and adjacent to protected areas. Unfortunately, few of the many existing laws and policies pertaining to agriculture and rural development provide specific guidance or support for biodiversity or forest conservation, with the exception of some broad-sweeping endorsements of the importance of sustainable uses of natural resources (CONAP 2006b).

3.1.6 THE PRIVATE FOREST INDUSTRY

Guatemala's principal forest products are logs for sawn wood production and fuelwood. The average annual volume of harvested timber destined for the national forest industry is approximately 575,000 m^3. However, a considerable amount of timber is harvested illegally, although exact estimates of the amount of timber lost are difficult to determine. Estimates of illegal timber harvests range from 30 to 50% of the actual volume reported, which would amount to an additional 172,000 – 287,000 m^3, or a total

annual harvest between 747,000 and 862,000 m^3 a year (Stoian and Rodas 2006). Annual consumption of firewood has been decreasing in recent years, although it continues to serve as an important source of cooking fuel for at least 60% of the population.

Data on primary and secondary processing of forest products in the timber industry are very limited. Earlier estimates indicated that approximately 1,000 forest product processors and about 1,100 forest product retailers are registered in Guatemala (Stoian and Rodas 2006). However, the actual number of sawmills and secondary wood manufacturers (furniture makers, woodworkers, etc.) is assumed to be significantly higher. Most processing facilities are small enterprises processing softwood, with low technical and technological capacities and unreliable supplies of raw materials. This generally results in poor product quality, high levels of waste, and very little value added to final products. However, a few large enterprises operate that meet export standards and supply the international market. The forest processing sector only manages two industrial concessions in the Petén region. All other processors depend on third party suppliers for raw materials.

Approximately 90% of harvested timber is destined for the national market. Estimates suggest that perhaps 68% of the processed volume is marketed as sawn wood, 14% as manufactured goods, 8.6% as plywood and wood-based panels, and 9.4% as miscellaneous products. An estimated 70% of the processed wood originates from coniferous forests (FAO, 2003). This suggests that coniferous forests, despite their limited area, continue to serve as perhaps the most important source of industrial round wood.

Export sawn woods are dominated by pines (*Pinus* spp.), which have accounted for more than 75% of export sales in recent years. Mahogany (*Swietenia macrophylla*) may account for more than 20% of export sales, with Santa María *(Calophyllum brasiliense*), Paloblanco (*Cybistax donnell-smithii*), Tropical Cedar (*Cedrela odorata*), and Castilla (*Castilla elastica*) comprising much lower percentages. An additional 12 species have also been included in export sales, but at very low volumes. Exports are principally destined mainly to El Salvador, the United States, the Dominican Republic, Honduras, and Mexico, while imports originate principally from Costa Rica, Mexico, the United States, Nicaragua, and Chile (Stoin and Rodas 2006).

NTFPs continue to serve an important role in forest-based livelihoods, particularly in the Petén region. Chamaedorea palms (*Chamaedorea* spp.), locally called "*xate*," *chicle* gum (*Manilkara zapota*), and allspice (*Pimenta dioica),* are the country's commercially most important NTFPs. According to CONAP statistics, 4.2 million lbs. of *xate* and 300,000 lbs. of *chicle* are produced annually, worth US$660,000 and US$309,000, respectively (FAO 2003).

Guatemala's forest sector, combining timber and NTFPs, is estimated to contribute approximately 2.5% of the GDP. It generates an estimated 37,000 jobs, involving slightly more than 1% of the economically active population. Table 3.2 includes a recent summary of forest sector characteristics.

Table 3.2 Characteristics of the Forest Sector in Guatemala

Forest Industry	
• Registered forest product processors	1,054
• Forest product retailers	1,097
External timber trade	
• Exports	$23.2 million
• Imports	$10.4 million
• Balance	$12.9 million
Macro-economic indicators	
Percentage of GDP	2.5
Direct employment (jobs)	36,878

Cited in Stoian and Rodas 2006

Forest ownership in Guatemala is divided into three major categories: (1) private forests, (2) national forests, and (3) communal or municipal forests (Table 3.3). Forest types and management goals differ significantly throughout the country. For example, the community forests in the highlands consist mainly of coniferous or mixed forests and principally produce firewood and construction wood for household consumption and the domestic market. In contrast, the community forest operations in the Petén region consist largely of broadleaved forests producing precious woods and lesser-known species for the national and international market, along with extensive production of non-timber forest products (Stoian and Rodas 2006).

Table 3.3 Forest cover in Guatemala in 2006 according to ownership type

Type of ownership	Area (ha)	Percentage (%)
Private	1,531,133	37.8
National	1,367,732	33.8
Municipal-Communal	934,630	23.1
Other	212,521	5.3

Cited in Stoian and Rodas, 2006.

As described above, the forestry sector is highly dispersed, with an uncertain number of actual forest operators, and limited communication and coordination among actors. However, as mentioned above, considerable effort is now being extended to improve communication and coordination. Associations of private forest producers exist in more than 150 municipalities across Guatemala.

Timber harvests for forest products other than those used for household consumption require an approved forest management plan and license issued through INAB. Forest and agroforestry plantations similarly require plan approval from INAB. Forest operators in protected areas, such as the forest concessions leased in the Maya Biosphere Reserve, must fulfill similar review and licensing procedures through CONAP. The overlap in forest management responsibilities between INAB and CONAP has been cited as a bureaucratic complication by some operators, particularly those with management areas extending across both lands administered by both agencies.

Monitoring and enforcement of forest laws, and prosecution of violators, has been dispersed across a multitude of agencies. INAB and CONAP are responsible for overseeing much of this work. However, both agencies have largely delegated monitoring and enforcement responsibilities to municipal governments. Allegations of wrong-doing generally are handled by the Directorate of Nature Protection (DIPRONA), acting to provide the research to support cases sent to courts. Unfortunately, few municipalities have the trained personnel, infrastructure or other resources required to fulfill this mandate.

3.1.7 NATIONAL AND INTERNATIONAL NGOS

The national NGO environmental community was previously led by the National Association of Non-Governmental Organizations Natural Resources and Environment consortium (ASOREMA), originally founded in 1995 by a large coalition of organizations. However, the influence of ASOREMA has waned in recent years and most of the national NGOs now operate somewhat independently or in association with one or more of the international environmental NGOs. All of the national and local NGOs are largely dependent on donations, grants, and contracts with government and international development agencies, foundations, and private benefactors to sustain projects and recurrent administrative costs. As such, they often suffer from insufficient operating revenue and uncertain long-term strategies.

Fundación Defensores de la Naturaleza (FDN) continues to represent one of the more important national NGOs working with biodiversity and forest conservation. FDN concentrates on integrated conservation and development initiatives (ICDPs), and has been actively engaged in projects engaging 16 municipalities and 150 communities since 1983. They have been assisting nine municipalities and more than 500,000 residents with a water marketing and watershed conservation initiative in the vicinity of the Sierra de las Minas Biosphere Reserve, and another payment for ecosystem services watershed and water marketing project in the Motagua Polochic System. FDN also manages several prominent protected areas within the SIGAP through co-management agreements with CONAP and direct delegation from the Congress of the Republic, including the Sierra de Lacandon National Park in the Petén and the Sierra de la Minas Biosphere Reserve.

Fundación para el Desarrollo y la Conservación (FUNDAECO) is an NGO founded in 1990, and is responsible for the co-administration of the Cerro San Gil Springs Reserve and the Rio Sarstun Multiple Use Reserve along the Caribbean coast. The NGO is also actively engaged in conservation efforts in the Sierra de Santa Cruz special protected area, Sierra de Caral, and the Sierra de los Cuchumatanes. FUNDAECO also has programs to strengthen national and local policy measures and increase environmental education programs throughout the country. Recently, the NGO increased its attention to the development of technical responses to the impacts from climate change. FUNDAECO operates with a strong local presence, and has four offices in Izabel and two in Huehuetenango provinces.

The NGO Fundación Mario Dary (FUNDARY) was established in 1989 with a focus on biodiversity conservation and sustainable development. The NGO is strongly focused on the management of the Punta de Manabique Wildlife Refuge, and they maintain a central office in Puerto Barrios to support these efforts.

Asociación Balam is a smaller NGO concentrating on engaging civil society in conservation initiatives in the Petén region, and working closely with the Wildlife Conservation Society (WCS). Balam helps communities develop legal agreements with public agencies such as CONAP, and supports improved governance practices.

Other NGOs such as Fundación Solar, Ati´tala, and ProPeten are implementing important geographically localized programs that include biodiversity conservation components.

The international conservation NGOs with important forest and biodiversity conservation programs currently working closely as partners of USAID include Rainforest Alliance and theWildlife Conservation Society. Other international conservation NGOs with active programs in Guatemala include Conservation International; The Nature Conservancy, and World Wildlife Fund (WWF). Counterpart International continues to work as a close partner of USAID and concentrates its work on sustainable tourism, with a strong program operating in association with Asociación de Comunidades Forestales de Petén (ACOFOP) in the Petén region. Training and technical assistance is provided in business management and administration, and innovative agri-tourism programs are being promoted throughout Guatemala. CPI is also advancing sustainable tourism programs in Alta Verapaz, Izabal, and

Quetzaltenango, and linking outcomes to national economic indicators. CPI is also collaborating with RA to produce a "Best Practices" manual to assist sustainable tourism operators seeking to achieve international certification for their operations. A tourism resource map is also in production, with collaboration from Instituto Guatemalteco de Turismo (INGUAT), Guatemalan National Coffee Association (ANACAFE), and the National Geographic Society (NGS), as part of NGS's "Geo-tourism" initiative. The NGS initiative integrates social, cultural, economic, and ecological factors to highlight the tourism values of distinct sites and areas. Guatemala continues to represent the first country in which CPI and NGS are applying the geo-tourism concept at a national scale.

RA is largely focused on assisting community-based organizations and private businesses, small and medium enterprises (SMEs) develop the administrative and management capacity to carry out sustainable forest management for timber and NTFPs. RA works closely with the Asociación de Carpinteros de Petén (ACARPET) to assist with plantation forestry, and assists several forest concessions with the commercialization of products. RA also assists with pricing schemes, building market links for products, contract negotiations, and related commercialization needs. RA is also now one of the leading NGOs engaged in the assessment and potential development of markets for forest-based carbon emission reduction credits. Assessments have been prepared to evaluate the economic and ecological potentials for locally based forest-carbon initiatives, and RA is working with government, CBOs, and private business interests to explore the viability of carbon markets. A new program, "GuateCarbon" is now working to convert these studies to viable project submissions for carbon credits, with 10 forest concessions, bringing together eight community organizations and two industries. RA also continues its work to promote sustainable coffee production in the upland areas, with a particular focus on integrating biodiversity conservation values into certified commercial productions.

WCS has carried out extensive wildlife surveys in Guatemala, with a particular concentration on monitoring indicator species that can guide public and private protected area planning and management. However, WCS has recently been carrying out extensive assessments of possible climate change impacts, particularly looking at seasonal and annual changes to surface water supplies, and changes in the frequency, duration, and intensity of forest and grassland fires. A comprehensive set of studies have been carried out for the Petén region from 1997-2007, incorporating predicted impacts of climate changes on the El Niño phenomenon. WCS is also actively developing the technical resources to assist CBOs and private businesses to develop viable projects for forest-based carbon emission reduction credits, with a particular focus on the concession areas and communities in the MBR.

World Wildlife Fund remains actively involved in biodiversity research and monitoring in and adjacent to protected areas. WWF also has a program in community-based forest management that includes activities being implemented in the vicinity of the MBR and in Izabal Province, including both sustainable management of natural forests and forest restoration and plantation projects. WWF has assisted more than 90 communities with management planning for a wide range of forest products, including such NTFPs as *xate*, and the preparation of forest management plans that comply with Forest Stewardship Council (FSC) certification standards. WWF has also provided technical assistance to communities engaged in PINFOR projects, and is actively engaged with freshwater conservation and management initiatives. WWF is also carrying out perhaps one of the more extensive assessments of impacts from incidental and commercial fishing in the Pacific coastal areas, including monitoring of fish spawning and forage sites.

The Nature Conservancy and Conservation International are two other important international NGOs with diverse programs actively operating in Guatemala. Both NGOs were central partners in the development of Guatemala's debt for nature program and remain part of the program's operating board. TNC has also played an important role in the creation of private natural reserves, and continues to expand the number of private reserves being established throughout the country. TNC has supported

the establishment and strengthening of municipal regional parks and has been a principal funding resource for national NGOs. Conservation International is principally responding to opportunities to develop carbon emission reduction strategies, particularly in the densely forest areas of the Petén region.

3.1.8 PUBLIC RESEARCH INSTITUTIONS

The Center for Conservation Studies (CECON) is based at the University of San Carlos of Guatemala and was founded in 1981 within the Chemical Science and Pharmacy Faculty. CECON serves as a decision-making member within CONAP. There are three principal units within CECON dedicated to biodiversity and tropical forest conservation: the Protected Areas division, Center for Conservation Data, and the Botanical Garden. CECON focuses its resources and efforts on the development of scientific research and investigations, maintaining and cataloguing technical data and reports relevant to conservation planning and management, facilitating *ex situ* conservation efforts through permanent flora and fauna collections, and supporting broad-scale environmental education programs in Guatemala. However, the center also is responsible for the administration and management of seven protected areas, including the Cerro Cahuí Biotope, Laguna de Tigre – Escondido Biotope, El Zotz Biotope, Dos Lagunas Biotope in Peten, Mario Dary University Biotope in Baja Verapaz, Chocon Machacas Biotope in Izabal, and the Monterrico Natural Reserve in Santa Rosa.

CECON does not appear to have sufficient staff, equipment or infrastructure to support the ambitious management plans that have been developed for each of these areas. They have also been criticized for operating a very centralized and bureaucratic administrative and management structure, with high budget requirements due to their affiliation with the university (CONAP 2006b). At the same time, CECON has been praised for their innovative management and research methods in the protected areas in which they work.

3.2 LOCAL INITIATIVES – MUNICIPALITIES AND INDIGENOUS COMMUNITIES

The GoG has been actively pursuing a broad decentralization strategy for many years, with the ultimate goal of more actively engaging municipal governments, and traditional and indigenous communities in local permitting, monitoring, and enforcement of national policies. Examples of local organizations engaged in the administration and management of municipal protected areas include Ulew Che'ja, who works collaboratively with the municipality of Totonicapán to administer the Los Altos de Totonicapán Regional Municipal Park; the Association for the Integrated Sustainable Development of the East (ADISO), who administer the Volcán y Laguna de Ipala Multiple Use Area; and the Association of Ecological Agriculturists of Lake Chicabal (ASAECO), who administer the Volcán y Laguna de Chicabal Natural and Cultural Monument. Municipalities and traditional and indigenous communities now play an increasingly important role in the management and conservation of forests, particularly upland pine forests in the highland areas of Guatemala. In fact, many of INAB's programs are now specifically designed to support this decentralized forest management through municipal governments.

Most municipal governments maintain a distinct environmental unit, although virtually all are understaffed, poorly trained, and underequipped, with extremely limited budgets to cover recurrent costs. However, several international funders have already targeted municipal governments as high priority areas for technical assistance and strengthening. USAID has provided considerable support to develop and launch the Government of Guatemala's ambitious new rural development strategy, and to design and implement policies related to co-management of protected areas, indigenous community rights, property rights, tourism, forestry, and human needs.

3.3 FINANCIAL MECHANISMS FOR CONSERVATION

A range of national, private and international mechanisms have been put in place to help finance conservation initiatives. Some of these funds are proving to be more effective than others, although all continue to hold significant potential as important conservation finance vehicles.

FONACON: The Guatemala Fund for the Conservation of Nature (FONACON) is administered by CONAP, and seeks to provide funding for municipalities to strengthen their ability to participate in local conservation initiatives. FONACON principally solicits proposals for environmental projects designed by the technical or forest units of the municipalities in Guatemala. A significant number of municipalities have benefited from FONACON grants, with typical grant ranges of approximately US$35,000. Program resources come from the CONAP funds, with projects concentrating on environmental education, rescue of species, institutional support, control and monitoring, mitigation of climate change, and improvement and decentralization of protected areas' management. Most projects are designed for low-income communities located within or adjacent to protected areas. An average of 55 proposals is received each year, with approximately 15 selected for funding. The municipalities work collaboratively with local or national NGOs to co-finance activities within and adjacent to protected area.

FOGUAMA: The Guatemalan Environment Fund (FOGUAMA) is housed with the MARN and was developed to provide financial support for sustainable development projects. However, no recent disbursements have been made through FOGUAMA, and the program, while still active, is not presently providing any significant contributions to biodiversity or forest conservation initiatives.

FCG: The Guatemala Conservation Trust Fund (FCG) was created as a private conservation finance mechanism in 1991 to support projects and activities in conservation and sustainable development of the country. The FCG mission concentrates on actions to promote the conservation and sustainable use of biodiversity. The FCG has financed more than 100 projects, including initiatives concentrating on environmental law and policy; protected area management, training and environmental education; sustainable use of natural resources; research; and institutional strengthening.

FCA: The governments of Guatemala and the United States, in partnership with TNC and CI, signed an agreement to create the Fund for the Conservation of Tropical Forests (FCA) on September 8, 2006. The FCA established a $24 million "debt for nature" mechanism designed to support conservation and protection of biological diversity in areas of high conservation priority. FCA's agreement establishes that the FCA Fund must be executed through a trust fund. The trust fund was created on September 30, 2008, and it manages two accounts: a debt service account, that receives payments from the Government of Guatemala according to the defined payment schedule and the endowment account, formed by a fixed fund from which each payment is deducted, and which is unmovable; it must reach US$ 4.9 million in 10 years. The governability of the Fund for the FCA is under the responsibility of an Oversight Committee that ensures that all funds derived from the payments made by the Government of Guatemala, along with interests, income, and profits on capital are applied to the following purposes:

- Establishment, restoration, protection and management of parks, protected areas and reserves
- Development and implementation of programs for the sustainable management of natural resources, including land and ecosystems management practices
- Training programs to increase scientific, technical and managerial capacities of individuals and organizations involved in conservation efforts
- Restoration, protection or sustainable use of biodiversity

- Research and identification of medicinal uses of tropical forest plants
- Development and support for sustainable livelihoods for rural peoples living in areas of high biodiversity priority

The FCA has identified four priority geographic areas: various regions of the Maya Biosphere Reserve; the volcanic chain of the Western Guatemalan Highlands; the Motagua-Polochic System and Caribbean coast; the Cuchumatanes region. At least seven projects have been approved in the first cycle of funding and are currently in various stages of development or implementation. The FCA is administered by the FCG.

PINFOR: The program for forestry incentives (PINFOR) was developed by INAB in 1997 to promote greater incorporation of the Guatemalan population in the forestry sector. This program provides US$800 for every two hectares of forest planted or natural forest area managed. An individual or a collective group must own the land. Cash payments are provided for one year of forest establishment and four years of maintenance, and for five years to those individuals who propose reforestation and management of natural forests. The objective of this incentive is to compete with agriculture subsidies and to reduce the investment that is needed to develop a forest plantation. The target groups are landowners that traditionally have invested in agriculture. The program has protected about 160,000 ha of natural forest; the financial funds come from public funds through the national budget assigned to INAB. Similar types of incentives for non-landowners are now under consideration in the National Congress.

PINPEP: The small stakeholders incentive program (PINPEP) was established by INAB in 2006 and will extend to 2012. The principal objective of PINPEP is to engage small-scale forest stakeholders holding secure property rights in the development of natural forest management programs in areas of intact native forests, and the establishment and management of agro-forestry activities on other lands with forest potential. Landowners with security property titles in forested areas can receive economic incentives for five years to support approved initiatives, and the owners proposing agroforestry activities receive economic incentives for project establishment and maintenance.

PPAFD: The Pilot Program of Direct Support for Forests (PPAFD) was initiated in 2002 by the Ministry of Agriculture, Livestock and Food and will continue through the end of 2009. The PPAFD finances the sustainable protection and conservation of natural forests by providing payments for conservation activities deemed to protect watershed cover, particularly natural forest, and water resources. This payment for environmental services (PES) is designed to reduce the conversion of forest land to agriculture and improve the security of water supplies in rural areas. Payments are provided to beneficiaries (stakeholders, communal, private and municipal owners) for five years and project activities are currently directed towards 11 of the 22 political regions of Guatemala located in areas above 1,500 meters in elevation. An estimated 220 registered owners are now participating in the project, with more than 33,000 ha of natural forest under protection.

Several new private conservation finance mechanisms are become increasingly important, including small grant mechanisms administered by Rainforest Alliance, the Water Fund (Fondo del Agua), the Ocean Fund (Mar Fund), and Fonpetrol, financed though revenues from hydrocarbon exploration projects.

The most significant bilateral donors in terms of technical cooperation and financing for biodiversity and forest conservation include USAID, the Dutch Embassy , the European Union, the Danish International Development Assistance (DANIDA), Swiss Cooperation, German Technical Development (GTZ), the Norwegian Agency for Development Cooperation (NORAD), the Japan International Cooperation Agency, (JICA), and Spanish Cooperation. Multilateral cooperation has been received from the Global Environment Facility (GEF), Inter-American Development Bank (IDB), and World Bank. The IDB

continues to support a broad scale sustainable development initiative in the Petén that includes a strong transboundary element, tri-national protected area conservation in the vicinity of Trifinio National Park, and sustainable tourism programs. The GEF has supported a wide variety of projects ranging from regional and transboundary support for conservation of the MesoAmerican Reef to institutional strengthening for municipal governments.

The principal contributions by USAID to biodiversity and forest conservation are summarized in Section 6 of this report.

3.4 OTHER STRATEGIC INTERVENTIONS

3.4.1 FOREST CONCESSION UNITS

At the local level, Guatemala is advancing sustainable forest practices by promoting community-managed forest concessions. In 1990, the Maya Biosphere Reserve was created in Petén, covering an area of 2.1 million hectares with three distinctive zones: (1) the core zone, consisting of national parks and biotopes (747,800 ha); (2) the multiple use zone (MUZ), where forest concessions are located (864,300 ha); and (3) the buffer zone, where cooperatives and municipal common lands are located and where land use is generally restricted (approximately 500,000 ha). Since the mid-1990s, more than half a million hectares of broadleaved forests have been granted as forest concessions in the MUZ. These concessions constitute the largest forest management units in the country. Of the 18 units established to date, 12 are community concessions, four are cooperatives or municipal common lands, and two are industrial concessions. All concessions are required to obtain forest certification according to the scheme of the FSC within three years of their establishment (Stoian and Rodas 2006). The certification process can significantly improve organizational capacity to sustainably manage the forest.

Community concession holders typically have previous experience with forest enterprise activities. Many have been historically involved with the collection and sale of *chicle* and *xate*, and have also developed close working relations with local wood processors and links with international markets. Several of the concessions have achieved forest certification, and all are working through the process. This training and guidance, combined with the secure access to the forest provided through legally recognized, long-term leases, has helped the forest concessions serve as a significant model of sustainable forest management. The communities' ability to generate jobs and timber sales has enabled them to make needed investments in harvesting and processing equipment to add value (Clausen 2000).

3.4.2 CONSERVATION ON PRIVATE LANDS

A strong movement to develop private nature reserves is taking root throughout rural Guatemala. More than 150 Private Natural Reserves (PNRs) encompassing approximately more than 30,000 hectares are registered with CONAP, and several additional properties are in the process of being registered. CONAP maintains responsibility for legally recognizing private natural reserves and INAB collaborates with reserve operators on projects including PES programs.

PNRs can belong to individuals, communities, groups/organizations or cooperatives. Virtually all of these reserves have been developed through the Association of Private Natural Reserves of Guatemala (ARNPG), an NGO founded in 1998 by a group of landowners, whose work is concentrated in three areas: biodiversity conservation; environmental education, including the creation of school materials for neighboring communities; and, watershed conservation. Most of the funding for establishment and management of the private reserves has been donated by international non-profit organizations. Yearly inscription fees are collected from association members to cover basic administrative expenses.

The ARNPG initiated a watershed conservation program in 2001 based on concerns from association members and other local stakeholders who identified water resource conservation as a priority concern.

USAID has supported this program through watershed assessments and management planning, including a review of legal frameworks; analysis of water quality and quantity; georeferencing of surface and groundwater supplies; and a monitoring plan. Private Natural Reserves play a key role enhancing the linkage between areas with poor connectivity. This has become one of the most important strategies to build ecological corridors and improve ecological integrity.

PNRs continue to grow in importance throughout Guatemala, with several new organizations actively promoting and facilitating their establishment, including the Association of Reforesters (Asociación de Reforestadores), Federación de Cooperativas de las Verapaces (FEDECOVERA), municipalities, and cooperatives.

4. THREATS TO THE CONSERVATION AND SUSTAINABLE MANAGEMENT OF BIODIVERSITY AND TROPICAL FORESTS IN GUATEMALA

Biodiversity is threatened by the direct and indirect impacts to habitat and individual organisms resulting from a wide spectrum of human actions. The area, structure, composition, and dynamics of tropical forests are equally threatened by many of these same factors. Most of the threats to biodiversity and tropical forests in Guatemala are due to actions that originate within the country. However, some threats, such as climate change disturbances, are global in nature, and others, such as the impacts from illicit drug and wildlife trafficking, are transnational. Solutions to local impacts from these global or regional threats can be proposed within Guatemala, but broader solutions will likely require transboundary or international responses.

The most significant threats to the conservation of biodiversity and tropical forests in Guatemala include the following:

- Habitat loss, degradation, and fragmentation – specifically resulting from unmanaged fires, land conversion for agriculture, land conversion for mineral and petroleum development, the introduction of exotic or opportunistic species, and drug trafficking
- Over-exploitation of natural resources – specifically due to poorly managed forest product harvests, unregulated hunting of wildlife, wildlife collection for illicit national and international markets, and poorly regulated harvests of marine resources
- Environmental contamination from poorly managed liquid, solid and atmospheric wastes; and from poorly regulated mineral and petroleum development
- Climate change – the unpredictable changes that may result to weather and climate from atmospheric disturbances could significantly increase the risks and vulnerability of Guatemala's biodiversity and tropical forests. Because of increasing habitat fragmentation and a poor ecological integrity of some ecosystems/areas in the country, the resilience of biodiversity and tropical forests to mitigate or avoid possible climate change impacts may be severely compromised.

Each of these factors is strongly influenced by the cumulative interaction of six social and institutional drivers:

- Pervasive poverty and lack of economic opportunities
- Weak environmental management institutions
- Inadequate or ineffective policies
- Lack of coordinated land and resource use planning and management
- Unregulated human population growth and migration

- Lack of verified land titles

These six social and institutional factors represent root causes stimulating and driving all threats to biodiversity and tropical forests in Guatemala. The analysis of threats must ultimately take into account the causes for each of these six social and institutional conditions in order to accurately assess the magnitude of potential impacts and possible mitigation actions.

The global threat of climate change may represent the most pervasive and enduring threat, and could ultimately exacerbate all other threats through direct or indirect impacts to social and environmental conditions. All responses to biodiversity and tropical forest threats must in one way or another acknowledge the possible influence of climate changes that could worsen impacts or complicate mitigation actions.

The assessment also includes a cumulative qualitative analysis of all threats to biodiversity and tropical forests in Guatemala. The cumulative assessment ultimately ranks how severe the risk could be to biodiversity and tropical forests from each threat, and serves as a summary of the predicted impacts that could result if the threat remains unchecked.

4.1 HABITAT LOSS, DEGRADATION, AND FRAGMENTATION

Ensuring adequate habitat to support viable populations of native species is the foundation of biodiversity conservation, and the loss, degradation or fragmentation of natural habitat by humans is the principal threat to biodiversity worldwide (Groom et al. 2006). Habitat is considered *lost* when the structure, composition, and dynamics of the physical, chemical, and biological system has been so significantly altered that the original species and functions can no longer be maintained. The complete clearing of a forest and planting of a monoculture crop in its place would be a dramatic example of habitat loss. Habitat is considered *degraded* when the composition, structure or ecological dynamics of an area are altered in a way that reduces or prevents species from carrying out part or all of their livelihood needs. Degraded habitat may still be functional for some or all species, but its usefulness has been impaired and species experience greater constraints in fulfilling their life cycles. Degraded habitats will continue to sustain limited populations of some species, while others may experience precipitous declines or complete extinction. Habitat *fragmentation* includes a reduction in the area covered by a habitat type in a natural landscape, and a subsequent change in habitat configuration, with the remaining habitat isolated into smaller patches that are no longer connected to each other (Harris, 1984). One of the primary risks imposed by habitat loss, degradation, and fragmentation is a decline in the resistance and resilience of natural habitats. Resistance reflects the capacity of a natural habitat to persist despite adverse impacts. For example, fire-adapted grasslands are often seen to be *resistant* to many fires, generally dependent on the ultimate temperatures produced in the fire. Measures of resilience reflect the magnitude of disturbance that can be absorbed or accommodated by an ecosystem before its structure is fundamentally changed to a different state (Gunderson and Pritchard 2002).

Habitat loss, degradation, and fragmentation have been steadily transforming Guatemala's landscapes for centuries, and a considerable area of original habitat has already been altered. The principal causes of habitat loss, degradation, and fragmentation in Guatemala include the following:

4.1.1 THE CONVERSION OF FOREST LANDS TO AGRICULTURE

The transformation of forest cover to other land uses, particularly the conversion for agricultural production, is a major cause of habitat loss in Guatemala. An analysis of the area lost and types of forest most affected by deforestation and degradation shows a striking trend from the years 1950–2003 (Table 4.1). Almost 2.8 million ha have been lost during this period, representing approximately 39.6% of the standing forest cover that existed in 1950. More than two-thirds of the area deforested occurred in areas

of broadleaf forests. The annual deforestation rate is now estimated to be 1.4% which results in an average annual loss of approximately 73,000 hectares (Jolon-Morales 2008).

The Departments with highest rates of forest cover loss include Chiquimula, Jutiapa, Petén, Jalapa, Izabal, and Zacapa, with perhaps as much as 65% of annual deforestation occurring in the Petén. An estimated 61% of deforestation in Guatemala occurs outside protected areas, and, of the 39% recorded within protected areas, the highest pressures are being experienced in the Maya Mountains within the eastern corridor of the Maya Biosphere Reserve, and particularly in Laguna del Tigre and Sierra del Lacandon National Parks (IARNA-URL 2006). Interestingly, the Departments of Sacatepequez and Retalhuleu have recently reported gains in forest cover, primarily through recovering secondary forests and seeded or planted forest areas.

Table 4.1. Deforestation in Guatemala by Forest Type, 1950-2003 in ha (IARNA, 2009)

Years	Total Forested Area	Broadleaf Forest	Mixed Forest Types	Conifer Forests	Mangrove Forests
1950	6,973,923	5,100,662	977,988	418,084	189,115
2003	4,206,880	3,246,359	649,187	297,138	70,981
1950-2003	-2,767,043	-1,854,303	-328,801	-120,946	-118,134

Deforestation can significantly alter nutrient cycles resulting in changes to soil structure and reduced fertility. This can also lead to changes in vegetation composition and structure. Loss of forest cover can dramatically alter hydrological cycles, increase sedimentation, and introduce toxins into ecosystem. Deforestation is also recognized as contributing approximately 20% of global GHG emissions. The cumulative result of these individual impacts is often a decline in local populations or local extinctions for some species.

4.1.2 FOREST FIRES

An increase in the number and intensity of forest and grassland fires continues to contribute to habitat loss, degradation, and fragmentation in Guatemala. Most fires are the result of human actions, and may be set for such immediate purposes as the clearing of logging debris, land conversion to agriculture, or to induce wildlife movement during hunting. However, an increasing number of fires may be the result of lightning strikes or other non-human factors, and these incidents can be expected to dramatically increase as climate changes alter precipitation and temperature patterns and soil moisture regimes.

Forest fires can have significant impacts to habitat conditions, ranging from a complete elimination of the habitat if the core fire temperature is extremely hot, to a degradation of ecosystem dynamics. Fires can change soil structure and chemistry, and can significantly affect soil moisture infiltration and retention. This can result in an increase in erosion and surface water sedimentation, and may lead to a decrease in soil fertility. These soil and water changes can lead to dramatic changes in forest composition and structure, and can contribute to population declines or local extinctions for some species. Assessments conducted by WCS in the Petén region indicate that the area affected by unmanaged forest and grassland fires, and the heat intensity in these fires may be increasing in recent years. This pattern could be occurring elsewhere in Guatemala, although there are insufficient data available to fully confirm it. However, there is ample evidence to verify that unmanaged fires continue to degrade and in some cases eliminate the area of suitable habitat available for some native species.

4.1.3 ROAD CONSTRUCTION

The construction of roads creates access to intact forest areas and often contributes significantly to land conversion to agriculture, and illegal timber, NTFP, and wildlife harvests for bushmeat and live sales. Roads can also interfere with wildlife dispersal and migration routes, and can serve as the source for the

introduction and dispersal of exotic and opportunistic plant and animal species (Jolon-Morales 2008). Road construction can significantly increase the degradation of surface water quality from sedimentation, particularly immediately following construction and during periods of low or no maintenance.

Recent assessments in the MBR indicate that approximately 311,000 ha of lowland forest were lost or significantly degraded over a 30-year period following the opening of 10 new roads. The road construction severely fragmented habitat for jaguar, transforming six known habitat areas into 16 much smaller units, with an estimated loss of approximately 11.2% of habitat for each area. While the improved access has facilitated increased tourism, particularly in the vicinity of Tikal National Park, the actual costs in terms of degraded wildlife habitat and lost forest resources have essentially been internalized generating marginal benefits for local communities dependent on the lost forest resources (Jolon-Morales 2008).

This threat is complicated, however, by the fact that road construction and improved access for rural populations must remain a development priority for rural Guatemala. Guatemala's road network is characterized by low road density indexes and problems of access, especially in rural areas. Overall road network density in Guatemala is low compared to other countries in Latin America and to countries with similar income levels, land area, and population. This translates into serious access problems for markets, livelihoods, and human health and welfare needs. As shown in a recent Guatemala Poverty Assessment, 13 percent of households do not have access to roads that permit motorized vehicles. Approximately 28% of the households with access experience road blockages at some point during the year and 20% of these blockages extend for periods longer than five days (World Bank 2006). The need is not to stop constructing or rehabilitating roads, but to ensure that the construction of new, and rehabilitation of old access routes follow strict environmental standards and mitigate potential adverse impacts to biodiversity and forests.

4.1.4 MINERAL AND PETROLEUM DEVELOPMENT

Mining for precious metals, particularly gold, iron ore, and lead, has been a small- and medium-scale economic activity in Guatemala for centuries and continues to serve as a national and local revenue source. Mining contributes roughly 3% of Guatemala's GDP. Large nickel deposits in the Lake Izabal area, with an annual production capacity of 9,000 tons, have recently been developed, and explorations have identified several other important sites for nickel production. Barite, bentonite, kaolin, other clays, feldspar, gypsum, iron ore, lime, pumice, salt, limestone, sand and gravel, and silica sand are also produced, primarily for domestic use. Exploratory studies continue on deposits of copper, quartz, manganese, uranium, mica, and asbestos. Gold production had declined in the 1990s, but has increased in recent years with an extraction of approximately 4,500 kg reported in the Huehuetenago District in 2001, up from 100 tons in 1998, and recent extractive operations in the Marlin Mine in San Marcos.

Oil production and pipeline development continues in the vicinity of the MBR. More than 30 wells are now operational in Laguna del Tigre National Park and more than 120 km of pipeline constructed. An estimated 526 million barrels of proven oil reserves are estimated to be recoverable within Guatemala's Petén basin, and are probably associated with those in Mexico's adjacent Tabasco formation. Oil production has fluctuated in recent years from approximately 21,000 barrels per day (bbl/d) in 2000 to more than 25,000 bbl/d in 2004, and then declining slightly to approximately 17,000 bbl/d in 2006 (EIA 2002).

Although mineral and petroleum production do not yet pose a severe threat to biodiversity or tropical forests, their production can threaten habitat conditions in a variety of ways. All production can introduce toxins into ecosystems. For example, the treatment phase for gold can employ toxic chemicals like cyanide, lead, mercury, and zinc to separate the profitable metals from non-marketable "waste." Cyanide can be fatal if ingested, and interferes with photosynthesis in plants. Groundwater can become

contaminated by the residue of treatment chemicals. Accidents and leaks during the transportation of the chemicals are also frequent occurrences. Exploration and development practices often result in complete habitat destruction in small, localized areas, and disturbances can affect wildlife movement patterns. Production can also contribute to GHG emissions.

4.1.5 EXOTIC AND OPPORTUNISTIC SPECIES

Exotic and opportunistic species introduced into natural systems can out-compete natural species and replace them in the ecosystem, thus reducing species diversity, lowering genetic diversity, and increasing the homogeneity of the landscape. Recent assessments indicate that Guatemala may now harbor as many as 51 invasive species, some deliberately or accidental introduced through human transport, and other self-introduced (IUCN 2005). Many of these species benefit from general habitat degradation, and some take advantage of degraded physical or chemical conditions to replace other native species as dominant representatives in an ecosystem. For example, water hyacinth (*Eichhornia carassipes*) is an ever-increasing problem in many Guatemala lakes, including Lake Petén Itzá and Lake Atitlán. Water hyacinth is a very fast-growing plant, with populations known to double in as little as 12 days. Infestations of this weed block waterways, limiting boat traffic, swimming, and fishing. Water hyacinth also prevents sunlight and oxygen from reaching the water column and submerged plants. It can shade and crowd native aquatic plants and dramatically reduce biological diversity in aquatic ecosystems.

Leucaena leucocephala is an example of a "conflict species" being widely promoted for its beneficial contributions to tropical forage production and reforestation. However, it also has a tendency to spread naturally and is widely reported as a woody weed. This small tree can form dense monospecific thickets and is difficult to eradicate once established. It renders extensive areas unusable and inaccessible and threatens native plants.

Africanized bees have invaded the Petén and have started to significantly affect the survival of some species, especially now that they are competing with other bee species and have started to alter the genetic variability in native populations. In addition, the Africanized bees build their hives in natural cavities, especially in tree species that are also used by other wild species. The Scarlet macaw (*A. macao*) is one of the species affected by the presence of these Africanized bees, since it has to compete with them for its natural nesting areas. These nests are even invaded by bees when they are active, causing the Scarlet macaw to abandon the nests (FIPA/USAID 2003).

4.1.6 DRUG TRAFFICKING

The clandestine transport of narcotics, particularly cocaine, is rapidly becoming a significant threat to biodiversity and tropical forests in Latin America. While there are few data available to quantify the direct impact of drug trafficking on biodiversity and tropical forests, there is significant conjectural information to indicate the probability of impacts. What is apparent is that the movement of these illegal substances provides an economic base that stimulates and dramatically increases deforestation, illegal timber sales, and a dramatic expansion of the agricultural frontier in previously pristine environments. Drug traffickers, only some of who are Guatemalan nationals, move into remote areas with an objective to store and ultimately transport the illicit products into regional international markets. Through local land leases and purchases, and contracted labor to sustain operations, the traffickers provide a significant source of funds to local communities, which, in turn, attract and increase in-migration as colonists arrive in search of land and opportunity. With increased funding, local residents increase illicit logging and replace native forest with agricultural crops and cattle ranches. Many of the drug traffickers participate readily in the illegal logging, farming, and ranching operations, in part to facilitate covert illicit operations, but also because these products can augment other income. Local workers are hired to clear and sell the timber on these ranches and oversee the cattle operations. Thus the by-products of drug trafficking – an exponential increase in illegal timber sales and legitimate sales of cattle, beef, and agricultural crops – create a boom economy that dramatically accelerates and expands the agricultural

frontier. However, habitat for biodiversity is severely degraded, fragmented or lost outright in the process, hunting pressures, and wildlife trafficking increase exponentially, and native forest is rapidly being converted to pasture and other less productive uses.

4.2 OVER-EXPLOITATION OF RESOURCES

Guatemala has a host of laws and policies dedicated to the sustainable use of natural resources and conservation of environmental services. However, the limited human resources and lack of infrastructure faced by every government institution and most of the NGO and civil society organizations results in insufficient monitoring and enforcement (Jolon-Morales 2006). Monitoring and enforcement is particularly constrained by the lack of reliable data on the state of biodiversity and forests and impacts from threats.

The threat from over-exploitation of resources can be categorized into the following sub-sectors: harvests of timber and non-timber forest products; harvests of wildlife for subsistence or commercial hunting; collection of live animals for sale in local, national and international markets; and, overfishing and harvests of marine species.

Natural resources continue to represent an important material source to meet subsistence and commercial needs in Guatemala. Recent estimates suggest that approximately 1,287 species are used regularly or occasionally to supply one or more need, including 726 forest trees, 259 fish species, 155 non-timber forest species, 63 bird species, 45 mammals, 18 reptiles, 16 crustaceans, and five mollusk species (Jolon 2006). However, some of the species used are not actually the primary target for collectors, but are instead harvested as a consequence of inefficient collection practices. For example, it is estimated that commercial fishing is largely concentrated on 35-50 species, with the remainder representing "by-catch" that may or may not actually be used for any subsistence or commercial purpose. These inefficiencies in biodiversity and ecosystem service uses represent a significant factor in the threat from over-exploitation of resources.

4.2.1 THE HARVEST OF TIMBER AND NON-TIMBER FOREST PRODUCTS

A considerable amount of the wood and other forest products in Guatemala are harvested and sold illegally. These illicit operations form a negative feedback cycle by significantly reducing available revenues to support forest management, monitoring and enforcement and thus preventing the promotion of sustainable forest and land use practices.

No reliable data exist to determine the amount of illegal logging that takes place. However, estimates suggest that illegal logging may account for between 30 to 50% of the volume of commercial timber harvested by year. For example, conjectural evidence from two municipalities indicates that as much as 66 to 77% came from illegal logging. Similarly, assessments have suggested that more than 50% of the wood sold in the local markets in Quetzaltenango and Huehuetenango is illegal.

The over-exploitation of non-timber products, such as *xate* palms, also increases the risk of habitat degradation. In some cases, the volume harvested only represents a portion of the volume that ultimately enters the marketplace, since much of the harvest is abandoned due to the poor quality of the materials selected or the destructive nature of the harvest practices. The leaves of the *Chamaedorea* palm are often indiscriminately harvested and sold in bunches, with no assessment of the impact these harvest may have on the remaining abundance or quality of this plant, or overall ecosystem degradation that may result through loss of plant cover, soil compaction, loss of soil fertility, or introduction of avenues for the spread of other exotic or opportunistic species. Some estimates also suggest that approximately 40-60% of *xate* harvests in the Petén are discarded because of the poor material quality. However, Rainforest Alliance continues to implement strong training and technical assistance with community

organizations in the MBR to improve the sustainable harvest and use of *xate*, in particular, and more than 180,000 hectares have been certified for sustainable *xate* production.

4.2.2 WILDLIFE HARVESTS FROM SUBSISTENCE AND COMMERCIAL HUNTING

Hunting of wildlife can be considered another subsistence and commercial NTFP use. Hunting is widely used by most rural residents in Guatemala to supplement subsistence food and income needs, and is largely unregulated and inconsistently monitored. An estimated 115 fauna species representing approximately 35 families are taken deliberately or accidently in the course of hunting practices. As mentioned in Section 2.8.3, Guatemala includes 1,234 species of animals included in the most recent International Union for Conservation of Nature (IUCN) red list for threatened and endangered species. One species is considered extinct, 39 are critically endangered, 49 species are endangered, and 57 are vulnerable. However, there are no reliable data to indicate the extent to which hunting practices or pressures contribute to these threats.

Guatemala has a strong history of concern for the control of hunting practices, and a considerable number of norms have been established over the past 100 years to promote the protection of target species. National hunting legislation was first passed in 1970 (Decreto 8-70), and the mandates of this national policy were reinforced in the legislation passed on protected areas in 1989 (Decreto 4-98). Many studies have been carried out by government, NGOs, and research institutions in the past 20 years to identify the species that are taken in subsistence and commercial hunting, and assess local hunting impacts. Unfortunately, most of the information and data on hunting in Guatemala has not been published or systematically organized to clearly indicate the magnitude or intensity of local or national hunting pressures (CECON-PROBIOMA 2005). Additionally, national and municipal agencies generally have insufficient human resources, training, and the necessary equipment to effectively monitor or mitigate hunting impacts, and much of the monitoring that does occur is done on a relatively haphazard basis by different research institutions and NGOs.

It is probable that some localized hunting practices contribute to population declines or local extinctions for some species. However, the extent of this threat is uncertain due to limited available monitoring and verifiable data.

4.2.3 WILDLIFE TRAFFICKING – NATIONAL AND INTERNATIONAL SALES OF SPECIES

A similar situation to unregulated hunting exists for the capture and sale of live animals to supply the pet trade, research institutions, and zoological collections. The principal markets for live animal sales continue to be in the United States, Europe, and Japan, with an increasing demand from Caribbean buyers. The over-exploitation of highly favored wildlife species, such as the endangered Scarlet macaw, other parrot species, and all of the native cat species, can drastically reduce populations, affecting the survival viability of these species. Scarlet macaw nestlings are taken from their tree cavity nests prior to fledging and are sold on the local market in the Petén for approximately US$250. The natural population of this flagship species is estimated at 250 individuals. Live specimens for the small cat species, and the pelts from jaguars are still commonly offered for sale to tourists throughout the Petén region.

The impacts on local populations for some live captured species can also be severe since the actual number taken can far exceed the number observed in markets. In some instances more than 90% of the animals captured may die before delivery to the final markets due to poor handling procedures. Smuggling procedures for wildlife typically include drugging and concealing animals in shipment containers and luggage, with very few professionals trained or equipped to monitor this transport. Some conjectural evidence exists to suggest that wildlife trafficking in Guatemala also relies on the same transport routes used to move illegal drugs, with possible overlap between these clandestine industries.

Guatemala has signed the CITES, and Resolution Conf.10.7 regulates the disposition of confiscated live wildlife listed under the Appendices. Governments are tasked with final disposition of the animals, whether it is to maintain them in captivity, reintegrate them into the wild or perform euthanasia. Captured animals typically require a rigorous process of rescue and ultimate disposition. However, there are an insufficient number of professionals or volunteers assigned to monitor and enforce existing laws and policies, and training for inspection personnel is not readily available. Guatemala also lacks equipped wildlife rescue centers to assist with public awareness and education programs, and to rehabilitate and release recovered animals.

Similar to the assessment of hunting pressures, wildlife trafficking may contribute to population declines or local extinctions for some species. However, the extent of this threat will remain unknown in the absence of verifiable data.

4.2.4 MARINE RESOURCES – TURTLES, SHARKS, AND WILD FISH STOCKS

Many deepwater fish species grow slowly, reach sexual maturity late, and may not always reproduce every year. As a result they have low resilience to intensive fishing, and recovery from overfishing can take generations. Unfortunately, commercial and subsistence fishing in the continental waters of Guatemala's Pacific and Caribbean coasts is poorly monitored, and few data exist to verify the magnitude of impacts. Conjectural evidence indicates that the number of commercial fishing fleets along both coasts can number in the hundreds, and artisanal fishing in the thousands. Trolling operations with more than 500 hooks per line extend across miles of unregulated seas, and some trawling operators extend nets to depths as great as 400 meters. Closer to shore, some of the commercial trawlers practice a particularly destructive form of bottom trawling that can virtually eliminate the catch in localized sites. Only a small percentage of these operations are registered and monitored by the Management Unit for Fish and Aquaculture (UNIPESCA) located with the MAGA, and the coastal areas can have fewer than a dozen field technicians available to patrol and monitor the vast marine ecosystems. These small and underfunded teams also lack the equipment, infrastructure, and training to facilitate the public awareness, education, and enforcement necessary to ensure sustainable use of Guatemala's rich marine resources.

Particular pressure is being placed on tuna stocks running along the Pacific coast, and on several species of shark and sea turtle, both of which are often harvested inadvertently as by-catch. Many pelagic fish species inhabit Guatemala's coastal areas, and there is some indication that Guatemala may provide the largest breeding ground for Pacific sailfish in the world. Other species sought by commercial and sport fishing operators include dorado, and blue, black and striped marlin.

The unregulated use of coastal and marine resources could result in population declines or local extinctions for some species, and destructive fishing practices, including the use of dynamite and toxic substances can degrade habitat structure and composition.

4.3 ENVIRONMENTAL CONTAMINATION AND DEGRADATION

While many habitats suffer significant degradation from unregulated disposal of liquid and solid wastes in Guatemala, the most pressing problems are probably found in the numerous lakes, rivers, and other surface water bodies distributed throughout the country. Lakes, lagoons, and rivers provide critical habitat for Guatemala's profoundly rich aquatic biodiversity, a considerable percentage of which is endemic and rare. These surface waters also provide essential potable water for adjacent human communities. However, a significant number of these surface water areas are experiencing high levels of eutrophication due to uncontrolled sediments and chemicals from agricultural runoff and unregulated disposal of sewage and other wastewaters. Water quality standards have not been fully implemented to limit contamination levels and, where standards are in place, no national or municipal agencies have sufficient staff, equipment or resources to enforce them.

The critical situation found at Lake Atitlán probably represents an unfortunate model of what is occurring throughout Guatemala. Lake Atitlán is the third largest freshwater lake in Guatemala, located in the western highlands in the administrative district of Sololá. The lake lies in a volcanic crater and covers an area of approximately 130 km^2. The lake is recognized to be the deepest lake in Central America, with its maximum depth estimated to be approximately 340 m. The lake and the lake region are rich in biodiversity, with 798 different plant species, 61 of which are endemic. The area is also rich in wildlife with 116 species of reptiles and amphibians, 236 bird species (12 of them endemic), and 141 mammal species (seven endemic). Lake Atitlán has served as the second most important national and international tourist destination in Guatemala for decades. However, the lake was recently recognized in the Fifth World Water Forum as one of the most threatened aquatic environments in the world since the assimilative capacity of the lake has been greatly reduced due to long-term excessive contamination from agricultural runoff, sewage, and other wastewater disposal. At various times a dense carpet of cyano-bacteria covers more than 75% of the lake's surface.

The authority for sustainable development in the Atitlán basin and its surroundings (la Autoridad para el Manejo Sustentable de la Cuenca de Atitlán y su Entorno, or AMSCLAE), CONAP, and relevant departments of MARN have evaluated several options to mitigate these problems from contamination, but do not have the human resources, equipment, or infrastructure in place to effectively implement concrete protection measures.

Biodiversity habitat and living conditions for human communities also face threats from declining quantities of water resources. Between 1970 and 2001 there was, on average, a 20-25% reduction in water flow in the country's rivers (World Bank 2006). Water scarcity is increasing and by 2025 availability of freshwater supplies suitable to meet habitat requirements for native species and human communities is expected to be seriously compromised by a combination of growing demand, unregulated direct and indirect liquid effluents, and solid waste disposal from both municipal and industrial sources, and the uncertain impacts from climate changes. The legal framework for conservation of freshwater is complicated because no framework water law exists. Water rights are ill-defined and managed by political and administrative divisions.

The impacts from this threat include a wide host of toxins introduced into native ecosystems, significant alteration of aquatic and adjacent riparian micro-climates, and possible population declines or local extinctions for some species.

4.4 CLIMATE CHANGE

Potential changes resulting from GHG emissions into the atmosphere may represent some of the most severe and enduring threats to biodiversity and tropical forests in Guatemala and globally. Some of the predicted consequences of increased GHG emissions include significant variations in precipitation and temperature patterns, accompanied by changes in soil moisture, chemistry, and plant community composition and structure. Local and national hydrologic cycles could be disrupted, and surface water supplies could become unreliable. Conjectural observations in the Petén region suggest that lakes and other small water bodies there are already experiencing consistently lower water volumes than previously recorded. Extended droughts or excessive flooding could also result in a significant increase in the migration of human populations in search of safer or more productive ecosystems.

Vulnerability to the impacts of climate change is a function of exposure to climate variables, sensitivity to those variables, and the adaptive capacity of the affected community. Often, the poor are dependent on economic activities that are sensitive to the climate. For example, agriculture and forestry activities depend on local weather and climate conditions; a change in those conditions could directly impact productivity levels and diminish livelihoods. Climate change has the potential to affect USAID activities in all objective areas.

Adapting to climate change involves reducing exposure and sensitivity and increasing adaptive capacity (USAID 2007).

There is also a direct link between Guatemala's efforts to reduce its national carbon footprint and biodiversity and forest conservation. Some estimates speculate that more than 60% of Guatemala's GHG emissions are due to consequences from deforestation and forest fires. Efforts to reduce deforestation and unmanaged fires could produce a significant reduction in national emissions.

Under these scenarios it is unlikely that the historic ranges of some species will remain constant, and this could significantly change conservation needs and priorities (Lovejoy and Hannah 2006). For example, under some future climate scenarios, many of the current protected areas will no longer be able to fulfill their role of protecting representative habitat for species targeted for conservation (Mansourian 2009). Protected area management may require dramatic changes to ensure adaptation to climate change, including habitat restoration with a focus on resilient habitats. Habitat management practices may also need to specifically include fire and pest control, and other associated threats which can be exacerbated by climate change. Habitat restoration could also become an essential need within protected areas and around them in targeted locations within the wider landscape.

4.5 CORE FACTORS DRIVING THE THREATS TO BIODIVERSITY AND TROPICAL FORESTS

Most of the principal threats to biodiversity and tropical forests have their roots in social, institutional, and economic problems that are pervasive in Guatemalan society. Any response to mitigate or eliminate threats will require actions that also mitigate elements of these root factors. The following summary reviews some of the factors driving these root causes. Section 5 of this assessment looks at possible responses that can help mitigate elements of these root causes.

4.5.1 PERVASIVE POVERTY AND LACK OF ECONOMIC OPPORTUNITIES

The pressures on rural populations to meet basic subsistence needs can produce a strong disincentive to adopt more sustainable land and resource use practices. The success of some sustainable ventures such as the forest concessions established in the Petén region shows that rural communities provided with secure land title, training, investment capital, and supportive government policies can readily adopt conservation practices. However, in the absence of these supportive resources the daily food, shelter, and energy needs of the poor can relegate them to using any means available to subsist. In a largely rural agricultural society, these needs can result in significant deforestation as people are driven to clear and cultivate lands less suitable for agriculture, and invade formerly undeveloped natural habitats.

Estimates from 2000 indicated that approximately 56% of the population in Guatemala, or about 6.4 million people, lived in poverty. About 16% of the population lived in extreme poverty (World Bank 2003). More than 75% of all rural populations in Guatemala are classified as poor, and 93% of the extremely poor live in rural areas. Although pockets of poverty are distributed throughout the country, some regions exhibit higher rates than others. For example, highly sensitive watersheds occupy 22% of Guatemala's countryside, but include more than 43% of the population and 54% of the remaining montane forests. The poverty rate in these watersheds is estimated to be 70%, compared with 53% for the country as a whole (Chomitz 2007). Approximately 20% of these sensitive watersheds are considered to be in critical condition, and all of these watersheds have extremely high poverty rates.

Economic growth depends on the integrated functioning of markets; the policy environment; institutions; and initial conditions, such as geography, social fragmentation, and base incomes. The ability of growth to create opportunities for the poor depends not only on the pace of growth but also on the pattern of growth in the economy. For example, employment opportunities in some sectors can be favored with the result that a large segment of society consequently experiences few, if any viable

employment. As a case in point, more than 80% of export earnings in Guatemala are derived from only a few agricultural crops, and only about 1% of individual earnings are derived from forest products. This further encourages the conversion of forests to agricultural lands, even where such uses are inappropriate. The poor also rely on an integrated portfolio of assets in order to create opportunity, including human capital (their own labor, education, and health), infrastructure (basic services, housing), natural capital (biological resources, environmental services), financial assets (savings and credit), and social capital (horizontal and vertical connections, informal and formal organizations). Unfortunately, the poor generally suffer from an unequal distribution of these assets, and have particularly limited access to infrastructure, financial assets and social capital. As a result, the most promising opportunities are provided through quick liquidation of natural capital to compensate for the absence of other assets. Habit loss and degradation, overexploitation of resources, and unregulated environmental contamination can often be the by-product of this situation, and can frequently be best mitigated by facilitating great balance in the distribution of the essential assets needed to build economic opportunity.

4.5.2 WEAK ENVIRONMENTAL MANAGEMENT INSTITUTIONS

As mentioned in virtually every section above, all of the national and municipal agencies responsible for administering sustainable environmental management suffer from insufficient trained staff, inadequate infrastructure, and a severe lack of funding to carry out the extensive mandates being placed on them. The limited human and other resources being allocated by the Government of Guatemala for environmental management severely constrains all efforts to control illegal activities, enforce existing legislation, and regulate public assets that fall under the jurisdiction of national and local governments. The lack of services available provides few opportunities for rural residents to escape from cycles of poverty, and virtually no control over illegal land and resource uses.

The lack of reliable data to guide conservation planning, decision-making, and management actions represents an additional problem that can further constrain opportunities to strengthen governance. Scientific research is carried out in a somewhat haphazard manner, with little institutional coordination on local or national scales. As a result, the intensity, frequency, and duration of threats to biodiversity and forests in Guatemala, including the evaluation of all threats indentified in this report, are often based on qualitative or conjectural assessments. While these qualitative assessments may be broadly accurate, they are not always sufficient to support locally appropriate interventions.

Guatemalan institutions also lack sufficient spatial data analyses to assess threat trends, and to verify actual land ownership. This latter factor can represent a major challenge for conservation action, since individuals, communities, and government agencies are often hesitant to commit limited financial and material resources to conservation without clear certainty of land and resource ownership.

4.5.3 INADEQUATE AND INEFFECTIVE POLICIES

While Guatemala has passed several important laws designed to protect and sustainably use the country's profound biodiversity and natural resources, many environmental policies lack sufficient clarity to allow for effective implementation. There is considerable overlap in jurisdiction in some policies, such as the shared assignment of protected area management responsibilities between CONAP and INAB which often creates significant confusion among local residents over the responsibilities and jurisdiction of each agency. The institutions responsible for enforcing biodiversity and natural policies, including CONAP, INAB, MARN, and particularly municipal governments typically lack the human resources, equipment, and recurrent budgets necessary to fulfill these mandates.

4.5.4 UNREGULATED HUMAN POPULATION GROWTH AND MIGRATION

In Guatemala, one of the driving forces behind habitat destruction and over-exploitation of resources is the 2.5% annual population growth rate in a population estimated to be greater than 14,400,000 in 2010 (IARNA 2009). This growth is due in large part to high fertility rates in the country – the highest in all

the Americas (TNC 2001). Approximately 40% of the population is under 15 years of age, and the average woman in Guatemala has 5.0 children during her lifetime, compared to an average of 2.9 children globally (World Population 2000). Population density is estimated to be approximately 104 persons/km2 in rural areas, and greater than 1,200 persons/km2 in the national capital region, making Guatemala the second most densely populated nation in all of Central and South America. Projections estimate that Guatemala's population will reach 16,295,000 by 2010, and at present growth rates will double in approximately 24 years (IARNA 2009).

Rapid population growth in inhabited areas has led to increased internal migration, as a largely agricultural society seeks access to arable land and moves into remote areas of lower population density, such as the Maya Biosphere Reserve and its buffer zone. Prior to the 1960s, the Petén region was largely uninhabited. Population densities were low and the natural resource base was minimally disturbed. However, migration from the densely populated highlands to the Petén has grown by a factor of 10 over the past 30 years, in part through government policies encouraging migration, but also due to perceived economic opportunities.

Although links between poverty and fertility rates are not well proven, the lack of access to education, finance, sustainable income opportunities, and appropriate health care among rural populations, particularly among girls and young women, may be exacerbating this problem (Merrick 2002). Policy responses to this factor may require programs that target all of these needs in an integrated manner, with particular attention given to youth and women.

4.6 PRIORITIZATION OF THREATS: TIMING, INTENSITY, AND FEASIBILITY OF INTERVENTIONS

A cumulative analysis of all threats was carried out by the assessment team to provide a concise summary of the principle threats to biodiversity and tropical forests in Guatemala from human activities and to rank the severity of each threat. An overview of the methodology used and results produced from this assessment is included in Annex VI. The assessment is based on a qualitative analysis of the following factors:

- The *intensity* of predicted impacts from each threat – with each threat assessed to predict if it would have no, low, medium or severe impacts; a determination of whether impacts would primarily affect individual species or have ecosystem-wide consequences; and an estimate of the total area likely to be affected by the threat, ranging from very small localized impacts to national-scale consequences
- A determination of whether the impact from threats appears to be direct or indirect
- The approximate amount of time likely to pass before impacts become evident, and the length of time they are likely to endure
- The feasibility of intervention by USAID based on an assessment of the human and financial resources required to effectively respond to the threat; and the availability of well documented, proven intervention models available from previous projects in similar contexts

Each of these factors was combined to assign a score predicting how severe the risk could be to biodiversity and tropical forests from each threat. Risk assessments are based on a scale of 1-5, with 1 representing minimal risk and 5 extreme risk. Scores of 1-2 on this scale suggest threats that are less severe, with interventions producing rapid and certain benefits. Scores of 3-4 on this scale suggest severe threats, with interventions required immediately and for extended time periods. Scores of 5 on

this scale suggest the most severe threats where a concerted regional or global response will be required for extended time periods.

The rank of each threat in terms of the severity of the risk posed is as follows:

Type of Threat	Risk Rank
Climate Change	5
Habitat Loss, Degradation and Fragmentation – Land Conversion	4
Over-exploitation – Marine Resources	4
Habitat Loss, Degradation and Fragmentation - Fire	3
Habitat Loss, Degradation and Fragmentation – Exotic or Invasive Species	3
Habitat Loss, Degradation and Fragmentation – Drug Trafficking	3
Over-exploitation – Forest Products	3
Over-exploitation – Wildlife Harvests for Bushmeat	3
Over-exploitation – Wildlife Trafficking	3
Environmental Contamination and Degradation	3
Habitat Loss, Degradation and Fragmentation – Road Construction	2
Habitat Loss, Degradation and Fragmentation – Mineral and Petroleum Development	2

All of the threats identified are significant and in need of action in order to ensure the security of Guatemala's biodiversity and forest cover. However, the purpose of this ranking exercise is to help provide guidance on the duration and intensity of intervention that may be required to respond to each threat. As the exercise suggests, some threats will require coordinated, multi-faceted, and long-term interventions to produce measurable and meaningful results (climate change, land conversion from forest to agriculture, and over-exploitation of marine resources). In contrast, the mitigation or reduction of other threats may be enhanced from smaller scale individual or localized actions, with perhaps more rapid returns on investments. A more comprehensive interpretation of this ranking process is included in Annex VI.

5. OPPORTUNITIES TO REDUCE OR MITIGATE THREATS

USAID/Guatemala is currently reviewing its plans and strategies for interventions in sectors that can affect biodiversity and tropical forests in Guatemala. This section of the assessment identifies actions that can strengthen the conservation and management of Guatemala's rich biodiversity and tropical forests. The analysis takes into consideration conservation actions being taken or proposed by other donors, government, national and international NGOs, and private business sectors. The review of opportunities is intended to serve as a possible "menu of options" for the Mission to consider in planning future initiatives. Section Six of this report correlates these proposed options to the threats identified in Section Four to show how the implementation of an opportunity can directly or indirectly mitigate, reduce or avoid the impacts from the threat.

5.1 MARKET-DRIVEN SERVICE AND PRODUCT OPPORTUNITIES

Economic incentives to biodiversity and tropical forest conservation can include rural business ventures designed to generate income and other financial benefits from activities such as the sustainable harvest of timber and non-timber forest products; payments from environmental services; tourism and other revenues from public and private protected area management; and reforestation and natural forest regeneration. Financial benefits for local and national businesses or CBOs can be derived from a wide variety of sources including product sales; payments from environmental service beneficiaries; biodiversity conservation grants; or endowment funds. Financial benefits for national or local public institutions can also result from service fees or forest or biodiversity use taxes. As an example of the potential impact from such economic incentives, the estimated annual gross revenues from similar natural resource product and environmental service initiatives in Guatemala may currently exceed US$20 million. These initiatives can be directly or indirectly linked to the conservation of more than 600,000 ha of forest ecosystems and an additional 10,000 ha of reforested lands (IARNA 2009). Such initiatives also generate an important socioeconomic effect through increased rural employment since most actions associated with these initiatives are labor intensive.

However, the potential benefits from a market-driven conservation strategy must be weighed against costs and risks. For example, market-driven mechanisms to finance biodiversity and forest conservation needs are certainly constrained by current economic conditions. Despite longer-term progress in reducing poverty in the 1990s, recent estimates suggest that poverty levels may have increased recently, particularly due to the recent economic downturn. A number of recent macro-economic shocks have undermined both economic expansion and poverty reduction. Problems in Guatemala's financial sector have also damaged overall confidence and could further put the brakes on investment. However, as a counter-balance to this caution, investments in natural resource enterprises, particularly those responding to climate and ecosystem amelioration, have not necessarily followed this same trend. For example, North American sales of forest-based carbon emission reduction credits actually increased in the fourth quarter of 2008, and the first quarter of 2009 despite the dramatic contraction of other economic sectors (Hamilton et al. 2009). Thus, while caution should certainly be employed when evaluating the return on investments in any market-driven conservation measures, such measures could continue to represent an important, if not essential source of conservation finance.

Section 5.1.1 emphasizes the critical need to strengthen business management and administrative skills particularly among rural businesses and CBOs. Sections 5.1.2 and the associated sections 5.1.2.1 –

5.1.2.3 examine the important role that payment schemes for environmental services can play to support market-driven approaches, and three specific PES strategies now being pursued in Guatemala.

5.1.1 BUILD BUSINESS SKILLS IN PRIVATE AND COMMUNITY-BASED NATURAL RESOURCE ENTERPRISES

The experience of rural development in the last decade has shown that micro- and small-scale enterprises have the potential to contribute to better management of natural resources, and provide income and employment opportunities to poor and marginalized groups. For example, local communities in the Petén region have been sustainably harvesting the natural gum *chicle* (*Manilkara zapota*), allspice berries (*Pimenta dioica*), and the ornamental *xate* palm (*Chamaedorea elegans and C. oblongata*) for the local and international floral industry. While timber is rapidly growing in relative importance, these three non-timber forest products alone provide a strong economic argument for landowners against converting the Petén forests to pastures for grazing or fields for agricultural commodity production. The viability of these products (plus other NTFPs and timber) will contribute greatly to the long-term conservation of the MBR. Since NTFP management in the Petén is largely an individual activity, reliable data on extraction rates and revenue generation is not easy find. However, when taken together, the management of these three NTFPs employs about 7,000 people, and the total annual income generated is about $47 million.

There is a wide variety of similar new enterprise opportunities that can be developed within a context of sustainable livelihoods that targets rural communities in areas of high biodiversity and forest cover. Local people have demonstrated a rich combination of productive strategies that often include agricultural, tree and forest products, and fisheries, as well as enterprising trades in both raw and manufactured products, such as handicrafts and tools. However, while local people may have strong natural resource assets and opportunities, their trading and enterprise initiatives suffer from a lack of competitive advantage due to many basic small business constraints including remote locations, poor access to extension services, inadequate planning and management skills, incomplete knowledge of value chains and market information, a lack of appropriate technology for value addition, insufficient market driven training programs, and difficulties in acquiring and using capital effectively. Thus, one very promising opportunity to use market mechanism to respond to biodiversity and forest threats in Guatemala could be measures to achieve the following:

- Provide training and technical assistance to small business and CBOs to strengthen their understanding of the key elements that influence community enterprise development, and linkages with sustainable rural livelihoods
- Develop rural business and CBO capacity to plan and implement sound micro- and small-scale enterprise development programs
- Increase rural business and CBO knowledge and understanding of the processes involved in the marketing of natural resource products
- Provide the analytical skills and knowledge to research potential products, the market situation, and market entry
- Provide opportunities for participants to share experiences and ideas on community-based enterprises, and the ability to convert these discussions into workplace outcomes

A wide variety of products and services can be provided through rural enterprises, and the following sections focus specifically on opportunities to develop payments from environmental service sales. However, establishing basic business skills and tools is perhaps the primary need before rural stakeholders will be in a position to use PES or other mechanisms to enter the marketplace. Rainforest

Alliance and Counterpart International are presently providing basic training in business skills and tools to rural communities through programs funded by USAID/Guatemala. However, an assessment of opportunities to increase and expand these programs could yield significant benefits for forest and biodiversity conservation while simultaneously enriching livelihoods.

5.1.2 PAYMENTS FOR ECOSYSTEM SERVICES

Conservationists seeking to apply market mechanisms to stimulate conservation finance are increasingly looking to the potential financial returns from payments received from users who benefit from ecosystem services. An example of a PES project at a local scale would be payments delivered by downstream water users to upstream residents in exchange for actions to protect the quantity or quality of water received. An example of a PES project at a global scale would be payments delivered by temperate country industries emitting carbon dioxide volumes in excess of agreed upon state, national or international standards to tropical forest residents in exchange for actions to protect forests that will sequester and store an amount of carbon equal to the volume emitted. PES transactions are typically voluntary and conducted between at least one service buyer and one seller; focused on a well defined service (or a land use likely to provide that service); measurable and verifiable; and, conditional upon contract compliance (Asquith and Wunder 2008).

PES programs can be implemented through unregulated private sector or civil society initiative, or in conjunction with government policy and sponsored programs. The following sub-sections examine the potential opportunities, risks, and benefits from three PES approaches that are currently being developed through NGO and private initiatives in Guatemala: carbon emission reduction programs; biodiversity offsets; and water banking. While these three approaches dominate PES efforts in Guatemala at the moment, they do not represent an exhaustive list of PES possibilities. Similar approaches can be employed to conserve any environmental service that now represents an externality unaccounted for in market transactions. However, the most active PES markets at the present time appear to be carbon emissions, biodiversity offsets, and water payments, and these three service markets could contribute dramatically to Guatemala's conservation efforts if they are developed with effective social and institutional guidelines.

FOREST-BASED CARBON EMISSION REDUCTION MARKETS

Forest-based carbon emission reduction (FCER) projects are designed to enhance the capacity of ecosystems to mitigate climate change by storing carbon above and below ground in vegetation and soils. Earlier USAID studies have estimated that Guatemala has the potential to sequester over 89 million tons of carbon by 2012. Projects can include those that concentrate on afforestation or reforestation of deforested areas (A/R); reduced emissions from deforestation and land degradation (REDD), typically achieved through the protection or sustainable management of standing forests; or a combination of A/R and REDD (REDD+ or mosaic REDD). USAID is supporting training and capacity building among local NGOs and CBOs to facilitate the development of A/R, REDD, and REDD+ initiatives, principally through Rainforest Alliance's work in the Petén region. Guatemala is actively moving forward with the development of a comprehensive FCER program at two scales:

- A national framework for developing (a) reference scenarios of historical and potential future patterns of deforestation and degradation and their emissions; (b) country-owned strategies for stemming deforestation and forest degradation; and (c) national measurement, reporting and verification (MRV) systems; and,
- Sub-national initiatives (individual site-based projects) designed to produce verifiable FCER projects through forest protection, conservation or restoration in fixed geographic locations throughout the country.

The national scale framework can provide the administrative structure and technical data necessary to support the verification of sub-national projects. The national scale framework for Guatemala is currently housed within the Climate Change Unit of MARN. The Climate Change Unit Coordinator has submitted a Project Identification Note (R-PIN) for Guatemala to the World Bank's Forest Carbon Partnership Facility (FCPF), with extensive input from a consortium of other government and NGO associates. The FCPF is a mechanism created by the World Bank to provide technical assistance specifically for REDD and REDD+ initiatives in World Bank member countries across the tropics, while piloting and testing approaches that may demonstrate how REDD can work. Guatemala is now one of 37 countries selected by the FCPF to test REDD and REDD+ carbon transactions for forest-based carbon emission projects. The R-PIN, if approved, will allow Guatemala to submit a full project proposal (R-PP) to the FCPF for partial funding to support the development of a national carbon accounting and administrative framework.

Establishing a national framework could greatly facilitate the preparation of the quantitative measurements and institutional protocol necessary to support any sub-national project proposals. However, the FCPF funding, if approved, will not likely provide all of the resources necessary to get this national carbon accounting and administrative framework in place. It is probable that creating this framework will require additional or matching funds to meet the full financial requirements of such an ambitious national effort.

At a sub-national scale several NGOs are preparing local assessments of FCER potentials, with a principal focus on the possibility of obtaining carbon credits from one or more of the rapidly growing voluntary carbon certification standards. Rainforest Alliance, the Wildlife Conservation Society, The Nature Conservancy, and Defensores de la Naturaleza are each collaborating with CBOs and private landowners to explore potential FCER certification for A/R, REDD, and REDD+ initiatives, with a strong focus on assessing the viability of forest-based carbon projects throughout the heavily forested areas of the Petén and Alta Verapaz. USAID/Guatemala is supporting some of these efforts particularly through the work being carried out by Rainforest Alliance.

There are presently two principal mechanisms for obtained certified credits for FCER projects. The Clean Development Mechanism (CDM) is a review body created within the 1997 Kyoto Protocol of the United Nations Framework Commission on Climate Change (UNFCCC) to help countries to meet their GHG emission targets.[1] However, the U.S. has not ratified the Kyoto Protocol and thus does not participate in implementation of Kyoto standards, thus limiting the opportunities to direct projects towards the CDM.

The CDM is also likely to undergo significant restructuring as a result of forthcoming climate change negotiations scheduled in Mexico December 2010 and this may create new opportunities for FCER projects in the near future. As one example, the CDM does not presently authorize credit certification for REDD or REDD+ projects, and the development of a mechanism to include such projects in a public compliance regime was verbally endorsed by the parties in attendance at the December 2009 climate negotiation meetings held in Copenhagen, Denmark. The CDM has also been criticized for being too cumbersome and slow in its response to project submissions, and as a result a separate voluntary emission reduction (VER) marketplace has emerged to establish standards to certify carbon credits that are sold outside the Kyoto Protocol compliance regime. The voluntary market is presently smaller and less liquid than the compliance market. However, it is growing very rapidly and some market opinions

[1] Emission reduction credits from the CDM are limited to Protocol Annex I countries, or those that are recognized to contribute the most greenhouse gases to the atmosphere. These are principally the world's more developed nations, excluding China and India. Each country that signed the agreement must demonstrate that it is reducing its carbon emissions by a fixed percentage.

suggest that the wider project scope provided through VERs could give this market strong potential to eventually outstrip the CDM compliance regime in terms of the volume of carbon credits certified and sold.

In the past four years a shift has been evident in the VER market to more structured growth. This may have been greatly facilitated by the development of credible intermediaries such as the Bank of New York, which created a registry for VERs in June 2006; the widespread acceptance of the minimum quality standard embodied by the Voluntary Carbon Standard (VCS), designed by the International Emissions Trading Association (IETA); and programs developed by non-profit organizations such as The Climate Group and WWF.

Voluntary markets are generally free of the stringent guidelines, lengthy paper work, and high transaction costs involved in CDM applications, and project developers have more freedom to invest in small-scale community-based projects. The co-benefits of these projects, such as local economic development or biodiversity, are often a key selling point to buyers.

The certification and sale of forest-based carbon credits from either the regulatory or voluntary markets could rapidly emerge as an important source of conservation finance in Guatemala. As such, several key lessons learned from early phases of both the UNFCCC compliance regime and voluntary markets can provide valuable guidance as Guatemala advances the development of national and sub-national FCER initiatives:

- The scale, location, and timing of FCER initiatives will likely depend on:
  - How quickly Guatemala can standardize the diagnostics, governance procedures, and MRV systems necessary to administer projects
  - Access to sufficient and timely financial resources for capacity building, policy, legal and institutional reforms, and investments
  - How effectively FCER readiness support programs can help translate emerging UNFCCC policy guidance into clear technical assistance
- Guatemala may need to place FCER initiatives at the center of national development policy to mainstream projects and enable cross-sectoral guidance, particularly by elevating carbon initiatives to the highest levels of government.
- Early and continuing engagement of representatives from key stakeholder groups may make national FCER readiness efforts fairer and more sustainable. Consideration should be given to the establishment of a national working group/steering committee with proper representation and expertise to prepare and advise on policies, legal and regulatory frameworks, and institutions; and strengthening the capacity of stakeholders, including private sector and civil society, and including Indigenous Peoples and local communities of forest-dependent people, to implement projects.

BIODIVERSITY OFFSETS

Biodiversity offsets are partnerships in which a developer agrees to compensate public or private biodiversity managers for the implementation of measures designed to mitigate or prevent adverse impacts to species or habitat. The goal of biodiversity offsets is to achieve no net loss, or preferably a net gain, of biodiversity on the ground with respect to species composition, habitat structure, and ecosystem services, including livelihood aspects. Although no biodiversity offset programs are in effect or proposed in Guatemala, the country does possess considerable opportunities to develop such

initiatives as potential conservation finance mechanisms, particularly with timber, high value agriculture product, toruism and hydrocarbon buyers and developers.

Offset agreements can be structured as public-private partnerships to establish payments for the development and management of biodiversity conservation projects. Biodiversity offset agreements can significantly reduce adverse biodiversity impacts arising from natural resource development proposals. Offset payments could be particularly valuable to protect remote and often poorly regulated areas.

The conservation actions involved in biodiversity offsets can include a wide range of management interventions to protect land, aquatic and marine ecosystems, and activities related to the sustainable use of biodiversity (UNEP 2008). They can be broadly categorized as:

- *Positive management interventions*, such as actively restoring, translocating or re-introducing existing or previously present biodiversity components, or removing invasive alien species
- *Controlling habitat loss, fragmentation or degradation* through such as actions as controlling pest plants or animals; establishing a fire management regime; stopping illegal resources harvests; increasing guard patrols; stopping soil erosion; or improving water quality
- *Averting anticipated future risks* through such actions as the development of a conservation easement that includes habitat conservation

Examples of typical land, aquatic or marine management interventions that can be included in biodiversity offset programs are summarized in Table 5.1.

Table 5.1 Sample Management Interventions for Biodiversity Offset Projects

Management Intervention
Restoring or rehabilitating degraded areas: Example: Replanting indigenous species on degraded land and removing invasive fauna and flora.
Strengthening protected areas: Example: Investing in additional management activities in neglected zones of a forest reserve (e.g. replanting degraded areas or removing alien invasive species) to improve its conservation status.
Protecting threatened areas: Example: Averting the risk of unplanned or illegal projects on unprotected land of value for biodiversity conservation by working with communities or with government to undertake conservation activities.
Sustainable use projects: Example: Developing horticulture of medicinal plants or creating sustainable use systems for hunted species that reduce the loss of biodiversity in the wild.
Addressing underlying causes of biodiversity loss: Example: Working with communities to develop alternative livelihoods through improved technical expertise in local management bodies, introduction of improved agricultural techniques, and the cessation of unsustainable activities (e.g. fuel wood chopping, crop plantation in forests, unsustainable levels of livestock) and replacement with alternative sustainable land management practices.
Improving habitat connectivity: Example: Identifying and securing the conservation management of land that provides biological corridors between protected areas or other areas of significant biodiversity value.
Establishing buffer zones: Example: Introducing or expanding a buffer zone around a national park.
Zoning marine areas: Example: Defining and protecting areas important for feeding and breeding of marine species. Working with companies and communities to avoid exploitation in these areas. Supporting alternative sustainable aquaculture initiatives for communities to compensate for lost income.
Securing species migration paths: Example: Establishing interventions to secure paths to enable the safe migration of land and air-based fauna.

Biodiversity offsets can help companies manage their risks more effectively and strengthen their license to operate by improving compliance with government standards, and securing the support of local communities and civil society. A growing number of companies, especially in the extractive sectors, have demonstrated that there is a business case for going beyond mitigation to compensate for the full impact that their activities have on biodiversity. Good management of environmental and social issues benefits companies' "bottom line" and, conversely, poor management of biodiversity issues, can harm financial performance. Companies are increasingly seeking to demonstrate good practice on environmental issues to secure their access to capital, permits, and maintain a competitive advantage as preferred partners with governments and other stakeholders. Conversely, bad environmental practice can lead to higher operating costs, costly permit delays, liabilities, and lost revenues. For companies, biodiversity offsets are a means of demonstrating a stewardship approach to the natural environment and justifying the continued access to the terrestrial and marine areas and natural resources needed for their operations.

Biodiversity offsets, if standardized as part of compliance requirements, also offer government regulators a mechanism to encourage companies to compensate fully for losses to biodiversity and make important contributions to conservation, in many cases with lower costs than alternative policies. Offsets can also help to ensure that project developments intended to meet growing demand for energy, minerals, metals, crops, and transport are planned in the context of sustainable development, and are accompanied by counterbalancing measures to secure the conservation of ecosystems and species affected by a project. Also, offsets can generate revenues from the private sector to enhance the budgets of government agencies and meet national biodiversity targets and goals (UNEP 2008).

The identification and development of concrete proposals for a biodiversity offsets program is beyond the scope of this report, and will require a detailed and integrated national analysis to identify sites of high and unique biodiversity and the presence of strong institutions to secure the long term management of these sites.

WATER BANKING

Water banking is interpreted in a broad sense to refer to measures that can enhance the capacity of ecosystems to regulate water flows and quality in a fashion that may benefit humans (e.g., influencing seasonal availability or nutrient levels). For example, in Jesús de Otoro, Honduras, the local Council for Administration of Water and Sewage Disposal (JAPOE) created a payment program to compensate upstream coffee producers for costs incurred to reduce agricultural wastes dumped into the Cumes River which serves as the town's main source of clean water. The villagers downstream paid approximately $0.06 per household per month to JAPOE, who redirected the money towards the upstream farmers. The farmers complied with various guidelines, such as construction of irrigation ditches, proper management of waste, and use of organic fertilizers.

Guatemala is now experimenting with similar initiatives. The Sierra de las Minas Water Fund was created to generate sustainable funding to support the restoration and protection of watersheds in Guatemala's Sierra de las Minas Biosphere and Protected Areas. Fundación Defensores de la Naturaleza and World Wildlife Fund's Conservation Finance program, which includes collaboration among a variety of partners including USAID/Guatemala, have established a user-fee based mechanism, the necessary legal structure, and better management practices to finance sustainable freshwater management in the region. Through this program, some of the major water users in the watershed pay a fee to utilize the resource; revenue earned from the fees is earmarked to a water trust fund, which disburses funds for watershed restoration and conservation efforts. Activities financed with these funds include reforestation, improving regional fire-fighting capacity, and environmental education targeted to improving water use practices.

Compliance monitoring in water banking projects has focused on the land uses stipulated in the contract. For example, in Bolivia's Los Negros Valley, 46 farmers bordering the Amboró National Park are currently paid to protect 2,774 ha of a watershed containing the threatened cloud-forest habitat of 11 species of migratory birds. In this PES scheme, annual contracts prohibit tree cutting, hunting and forest clearing on enrolled lands. Every 12 months the Project Control Team revisits the parcels of all farmers enrolled in the program to verify compliance (Asquith et al. 2008).

SUSTAINABLE TOURISM

USAID has been a prominent supporter of sustainable tourism development in Guatemala for many years, and the sector continues to represent an essential source of conservation finance for local communities and private businesses, as well as potential tax revenues to support government conservation programs. The number of tourism products available in Guatemala is remarkable for such a small country, and Guatemala can offer competition to any other regional site in terms of the diversity of natural and cultural resources of national and international interest. Infrastructure is generally good in the prime tourist areas, and the quality of services available to tourists meets or exceeds many other regional offerings. There is a need to increase efforts to ensure more equitable distribution of economic benefits from tourism operators, particularly within the traditional communities that are generally the target of visitors. However, many existing sustainable tourism development projects are already developing important and replicable best practices and model operations that can be widely replicated to achieve this social equity goal.

The more pressing need is to ensure that Guatemala maintains its reputation as a desired tourist destination. Guatemala is experiencing a current decline in visitation rates which is likely due, in part, to the recent market setbacks. This constraint will likely self-correct as international and financial markets recover in the near future. The more significant threat to sustainable tourism in Guatemala is the dramatic degradation of security that is now rampant in several key tourism areas. This constraint represents a significant potential threat to sustainable tourism as a viable conservation finance mechanism.

Sustainable tourism operators will need to become active partners collaborating with municipal governments and national security agencies to establish strong control and enforcement webs in and adjacent to primary tourism destinations. Tourism operators will need training and guidance to learn the skills that will allow them to play a stronger role in monitoring and enforcing security threats. However, even more essential will be the need to significantly increase the number of trained and equipped police and civil patrol available to monitor and enforce civil codes in tourist areas. Robbery of money, possessions, and vehicles; sexual assault; and incidents of kidnapping for ransom are escalating in many key tourism destinations. Guatemala probably has a very short window of opportunity to demonstrate to the international community that these threats can be significantly reduced and controlled. However, without the commitment of the personnel necessary to demonstrate greater security in these areas a large number tourists may begin to avoid Guatemala for safer destinations, and a profoundly important source of conservation revenues and incentives essential to biodiversity and forest conservation could be lost.

5.2 STRENGTHENED APPLICATION OF ENVIRONMENTAL POLICIES

In Guatemala, *in situ* and *ex situ* biodiversity and tropical forest conservation are principally carried out under the jurisdiction of the Ministry of Environmental and Natural Resources, and the associated National Council for Protected Areas, along with the National Forest Institute, and the Ministry of Agriculture, administered by a multitude of agencies within the Government of Guatemala, including the five Authorities of River Basins from the River Pensativo, Lake Izabal-Río Dulce, Lake Amatitlán,

Lake Atitlán, and Lake Petén Itzá, all of which plan, coordinate, and execute management actions in their respective river basins with the participation of local stakeholders.

During the past two years the GoG has worked closely with international cooperation agencies to develop the Round Table for the Environment and Water. This Round Table was created to place the environment and water sectors as a national priority and in accordance with the terms of the Paris Declaration on Aid Effectiveness of 2005. The Round Table provides a forum for high level dialogue among the GoG and the countries and cooperative agencies working with it. The Round Table aims to apply the principles of the Paris Declaration and facilitate the GoG's efforts to develop strong environmental initiatives that are aligned with development goals. The Round Table also works to connect donor agencies to appropriate government institutions and programs in order to unify, reduce, and harmonize GoG environmental standards. The Round Table further aims to establish accords and frameworks of mutual responsibility between the GoG and donors in order to strengthen assistance programs and achieve national development objectives (MARN-URL-IARNA-PNUMA 2009).

As discussed in Section 4.5.3, Guatemala has a great deal of legislation in place to support biodiversity and forest conservation, but lacks clarity in the interpretation of these policies, and significantly lacks the human resources, equipment, and infrastructure to effectively fully implement policy mandates. The implementation of all biodiversity and forest-related policies could perhaps be enhanced through the implementation of one overriding national environmental policy that clearly states institutional responsibilities in a manner that minimizes overlap and encourages collaboration and shared resources, and that also orients the country toward specific goals with short-, medium-, and long-term priorities. Although MARN has issued a policy on Environmental Conservation, Protection, and Improvement, the mandates within it are not shared among all government agencies with environmental responsibilities (World Bank 2006). The Environmental Cabinet and the Consultative Council within MARN could perhaps take primary responsibility for developing a policy that more comprehensively represents all appropriate government agencies.

In the short term, this proposed policy could identify measurable results to provide at least a two-year set of biodiversity and forest conservation priorities, while also clearly defining responsibilities and resource allocations among all appropriate GoG institutions. Ideally, the development of such a policy would occur at the highest government level feasible, with training and technical assistance provided for those involved in the preparation process. Cross-sector coordination and an improved decision-making process would also be essential since biodiversity and forest resource conservation needs cut across economic sectors and multiple institutions.

A unifying national policy could incorporate the following measures or stimulate other closely associated policy mechanisms that include them:

- Prioritize threats to biodiversity and forest ecosystems in terms of their effect on economic development and poverty reduction, using both quantitative and participatory techniques, and develop action plans that respond to identified threats and engage all stakeholder sectors in selected responses. A specific effort should be made to include all of Guatemala's coastal and marine ecosystems in this assessment and prioritization process.

- Quantify the human resources, infrastructure, and funding levels required to comply with existing and proposed biodiversity and forest legislation, and establish action plans to leverage the funding necessary to achieve this required capacity. Some of this work has already begun. CONAP has signed the National Implementation Sustainable Partnership in order to implement the Program of Work on Protected Areas under the CBD. Under this agreement, an ecological gap assessment has been prepared, along with an institutional capacity assessment, action plan, and financial gap analysis

- Coordinate and consolidate data and mapping to maintain updated and verifiable measures of deforestation and overexploitation threats, and ensure improved public access to these data, with, again, specific measures of coastal and marine resources and threats.
- Coordinate agricultural and forest policies to reduce land use conflicts, such as those that have occasionally led to conversion of reforested lands to agriculture after PINFOR payments end.
- Delegate responsibility and resources to local government and NGOs to enhance the monitoring and enforcement of illegal logging, hunting, overfishing or other inappropriate land and marine resource uses, particularly in protected areas and adjacent buffer areas.
- Develop a national accounting system assigning monetary values to environmental services and resources, particularly those found in forested watersheds and marine ecosystems, and specifically including values for carbon, water, and biodiversity.

A unifying policy or associated mandated actions should also include the following measures to ensure broad social commitment:

- Identify mechanisms that bring together different viewpoints during the policy formulation and implementation process, particularly the viewpoints of the most vulnerable groups.
- Identify mechanisms that ensure social accountability in the context of environmental issues such as passage of legislation for greater transparency in decision making and outcomes.
- Identify mechanisms through which social learning can occur so that key environmental priorities are prominent and always included in the policy agenda so that incremental improvement can occur over time.

5.2.1 STRENGTHENING INSTITUTIONAL COORDINATION IN BIODIVERSITY AND FOREST CONSERVATION

Considerable benefits could be generated by establishing a "Consultative Council" at a high government level to serve as an advisory board to the Ministry for biodiversity and forest conservation policy and regulation. The Council could provide recommendations on the formulation and design of sector policies and norms, recommend actions that support compliance with the legal framework, and act as an information source to support transparency and public participation. Council representation could include all stakeholders with biodiversity and forest conservation monitoring, management, and administrative responsibilities, including representatives from the public and private sectors, and civil society.

Similar councils have been employed in Guatemala in the past, but have never been formally established within and among the various national institutions. There may be benefits in revitalizing this approach as a formal inter-institutional decision-making body, and expanding their scale and jurisdiction. Ideally, such a council can minimize institutional competition, improve communication and maximize the benefits from shared limited resources.

Institutional coordination can also be enhanced through agreements to decentralize some management and monitoring responsibilities to existing environmental units in municipalities. National scale collaboration and coordination with municipalities should particularly provide technical standards, technical assistance, and training that will improve municipal performance in monitoring changes to biodiversity and forest conditions.

In the short term, national scale dialogues should advance agreements with more populated municipalities (those with a population over 100,000) in order to mainstream municipal projects that are,

in turn, presented to national agencies for financing. A national scale dialogue can also be developed with municipalities through the ANAM in order to clarify threats, validate mitigation needs, and coordinate roles and responsibilities for institutional responses.

5.3 STRENGTHENED ENVIRONMENTAL MANAGEMENT INSTITUTIONS

Biodiversity and forest conservation efforts in Guatemala continue to be constrained by national and local scale institutions that lack specific mandates, and the human resources, equipment, and recurrent budgets that will allow them to fulfill them. Increasing the human resources available to promote and guide sustainable use of biodiversity and forest resources, and monitor and enforce national and local policies can perhaps be achieved, at least in part, through public and private finances generated by the market-driven mechanisms described in section 5.1 above. However, the mitigation or reduction of impacts from threats to biodiversity and forests will also require training and equipment to enable the people working with conservation to effectively promote and guide sustainable development opportunities, and monitor and enforce land and marine resource uses, particularly through enhanced environmental information systems and improved regulations. The following sections examine specific needs and actions that can facilitate these enhanced mitigation measures. However, it should further be emphasized that all of the proposed measures will require a strengthened civil service that can maintain worker loyalty, commitment and enthusiasm for the ambitious conservation tasks at hand. Building these qualities can only be achieved in part through training and improved infrastructure. Allocating sufficient funds to create pay scales that are at least competitive with NGO and private sector opportunities will also be necessary. Civilian workers must also recognize sufficient job security beyond the term of government administrations to fully commit their loyalty to the missions of their agency.

5.3.1 IMPROVED MONITORING AND DECISION-MAKING WITH STRENGTHENED ENVIRONMENTAL INFORMATION SYSTEMS

Guatemala's biodiversity remains poorly studied and there is an enormous need to enhance the equipment and facilities available for taxonomic collection, curation, and systematic revision. There are eight centers of taxonomic expertise established in Guatemala with institutional reference collections that include herbaria, general collections of vertebrates and invertebrates, arthropods, and fungi. Priority needs for strengthening have been identified, and include professional training in taxonomic research, improvements in infrastructure and equipment, bibliographic resources, computerized recording of databases, improved communication between taxonomists and end users in general, and the simplification and streamlining of legal requirements for collection and exportation of specimens (CONAP 2006).

Guatemala also relies on isolated information systems. Environmental information is not comprehensive enough, or gathered in such a way as to be useful to decision makers and civil society. The information systems most utilized for environmental monitoring include the Geo-referenced Information System and the Health Management Information System. University investigation centers, including such centers as the Universidad Rafael Landivar, Universidad del Valle, and Universidad San Carlos de Guatemala also maintain environmental information systems. The Centro de Monitoreo y Evaluacion del Consejo Nacional de Areas Protegidas provides important spatial and other data pertaining to conservation management, and has been particularly important in monitoring the impacts of fires on forest conditions.

In order to create a unified information system it will be essential to establish uniform indicators that can inform biodiversity and forest conservation action plans for decision makers, and serve as the foundation for policy development and performance measurements. A national scale information system should also be established to support the monitoring of indicators and make all available information transparent and accessible to the full stakeholder community through a web-based platform.

A national system should also serve to strengthen Guatemala's existing role in SERVIR, a hub supported by USAID and other partners to collect and process climate information, test new and innovative tools, and then apply that information to development problems such as weather prediction, fire monitoring, red tides, and disaster response. SERVIR – Spanish for "To Serve" – is a Regional Visualization and Monitoring System that integrates earth observations (e.g. satellite imagery) and forecast models together with in situ data and knowledge for timely decision- making to benefit society.

The first SERVIR regional operational facility – for the Latin America and the Caribbean region – was established in 2005 through the efforts of NASA, USAID, CATHALAC, the CCAD, and other partners, at the request of the governments of Central America, as an innovative way to utilize space based assets for development. The system includes a Coordination Office/Prototyping Facility at the NASA/Marshall Space Flight Center in Huntsville, Alabama. The NASA SERVIR Coordination Office/Prototyping Facility articulates the overall program together with resource providers (host organizations, national governments, USAID, and other international cooperation agencies), and implements new technologies from NASA and other scientific research partner organizations, including U.S. Government agencies, international space agencies, universities, and NGOs that address the needs of countries. The SERVIR regional operational facility in Central America is responsible for facilitating the participation of other international and national organizations related to climate change, environmental monitoring, disasters weather, civil protection, and mapping in the region.

Within Central America and the Caribbean, the SERVIR team at CATHALAC has, to date, responded to over 20 natural disasters and 10 environmental threats across the region, as well as developed a geospatial portal which provides improved access to regional data and metadata. Both centers have a robust training and capacity building program which is strengthening the use of earth observations and models for decision making among government officials, scientists and researchers, NGOs, and academia.

STRENGTHENING THE USE OF SPATIAL DATA FOR CONSERVATION

Maps and other products developed from the rapid advances in remote sensing, geographic information system (GIS), and related technologies do serve critical planning and management needs, and provide effective educational and enterprise tools. Guatemala's government and NGO experience with geospatial mapping projects demonstrates that remote sensing, GIS, and other information systems can significantly contribute to applied conservation action when the information and products are managed in an open and transparent fashion, and products are made available to the general public. CEMEC-CONAP represents an extremely valuable source of spatial data analysis at the moment, and opportunities to enhance and expand their work can yield significant benefits for managers. However, there is a significant need to build from this experience and expand the use of spatial data to ensure that government agencies have the technical resources necessary to verify and monitor land ownership and land use changes at local and national scales. For example, no existing protected area in Guatemala has yet prepared the legal verification of its geographic boundaries. Management strategies can be constrained in the absence of this critical administrative data. Uncertainties over actual boundaries can also potentially elevate local and even transnational conflicts, particularly in the Petén region where the assumed boundaries of several of the protected reserves and even some of the forest concessions in the MBR appear to be inaccurate.

Some of the principal constraints to the more widespread use of geospatial data for biodiversity and forest monitoring and management are the limited amount of recent data at useful scales, and the limited opportunities for training in the application of spatial data technologies. Significant benefits can be derived from the development of short- and long-term training opportunities, particularly to increase the number of practitioners in all sectors capable of accessing and applying the increasing amount of open source software and spatial data available. Open source software and data is generally free of charge, but

can be much less user-friendly than proprietary data and software. Increasing the number of conservation practitioners with the tools and skills to use these data could be achieved through institutional short courses and faculty training to support the enrichment of existing natural resource programs at Universidad Rafael Landívar, Universidad del Valle de Guatemala, and University of San Carlos of Guatemala, among others.

Training, equipment, and technical assistance can also strengthen the capacity of national and municipal governments, NGOs and other civil society groups to carry out baseline surveys, monitoring, and ground truthing exercises necessary to support land titling and land use changes. Significant benefits can also be derived through initiatives to facilitate potential partnerships with the leaders in geospatial industry such as ESRI, DigitalGlobe, and Google, each of whom is supporting international conservation efforts with substantial in-kind donations of software and very high resolution imagery.

Training and technical assistance can also strengthen national and field scale capacities to apply mapping and monitoring methodologies that can be used at a community scale, but remain consistent with national scales. The methodologies should incorporate multi-resolution remote sensing data, GIS, and ground-based measurements using such readily accessible tools as Google Android ODK (Open Data Kit) mobile technology and the Google web-based Forest MRV (Monitoring, Reporting and Verification) platform that supports open and transparent access to satellite data. Methodologies can integrate community-based forest monitoring with a national assessment of products and services available to increase conservation finance (such as a national assessment of carbon emission reduction opportunities). The outcome could be a nationally and locally consistent set of methodologies synchronized to support regional and national biodiversity and forest monitoring and management.

5.3.2 IMPROVED LAND AND MARINE RESOURCE USE REGULATION

Despite the legal and administrative advances Guatemala has made in establishing strong commitments to conservation, one of the country's greatest challenges is achieving actual compliance with environmental laws, regulations, and standards. Compliance has thus far centered principally on the use of environmental impact assessments. However, the treatment of environmental infractions in the country's Penal Code does not allow evidence that would lead to corrective actions. A definition of what constitutes environmental damage is also lacking, making it difficult to apply sanctions with discretion. The system is also designed to sanction or prohibit actions that the country does not have the capacity to monitor (World Bank 2006).

As mentioned in section 5.2.1 above, MARN, CONAP, and INAB should consider delegating some monitoring and management functions to the environmental units of other ministries and particularly to municipalities. MARN should also review the role that EIA plays in environmental management and look for additional policy instruments (such as economic incentives, forest conversion penalties, and sustainable resource extraction standards) that could address environmental impacts in a more effective and efficient way.

A consortium of MARN, CONAP, and INAB could also consider leading a legal reform to improve their ability to monitor and enforce policy mandates, including possible modifications to the Penal Code and the legal framework for the environment sector (Decree 68-86); and the issuance of needed sector laws, such as a water resources management law, a law on citizen participation, and a law on public consultation. Institutional strengthening and technical assistance may also be valuable to support the definition of technical standards and monitor compliance.

5.3.3 NATIONAL AND REGIONAL BIOLOGICAL CORRIDOR INITIATIVES

Several initiatives have been developed to encourage the establishment of biological corridors in Guatemala that will create viable movement and dispersal routes to link fragmented intact habitats,

reduce habitat destruction, and restore degraded habitats. The most prominent of these initiatives is the Meso-American Biological Corridor that has been led by the World Bank. The MBC is a regional initiative to conserve critical ecosystems and promote sustainable development in the seven countries of Central America and adjacent southern Mexico. This ambitious transnational conservation effort has the following goals: (1) to consolidate the key protected areas of Central America, (2) to connect these protected areas with corridors of mixed land uses, and (3) to promote social and economic development in the corridors and around the protected areas that is compatible with biodiversity conservation and culturally appropriate (Tolisano et al. 2008).

The Mesoamerican Biological Corridor is implementing two new activities in Guatemala. The first involves the development of a system of corridors in the Trifinio region, a transboundary area connecting Guatemala, El Salvador, and Honduras and bordering the Montecristo Tri-National Protected Area. The Trifinio corridors aim to protect natural areas that can (a) serve as important catchment areas to recharge water supplies; (b) provide hábitat for rare, threatened, and endangered species, particularly the Quetzal (*Pharomachrus mocinno*); and (c) serve as important areas for sustainable coffee production. The second activity being undertaken through the CBM involves the development of biological corridors in the area known as the Nodo de Atitlan in order to link private reserves located in the volcanic system that slopes towards the Pacific Ocean. This second activity also includes measures to strengthen the operations of small-scale coffee producers and municipal reserves found in the Atitlan river basin.

One example of an outcome from the MBC is the "ECO-O.K." initiative to link and enhance bird habitat among upland coffee farms. Shade coffee farms are host to an abundance of biodiversity and provide a key habitat for a variety of songbirds. Sun plantations, on the other hand, destroy much of this important habitat. The ECO-O.K. coffee certification program was designed in response to great habitat loss in certain regions when many coffee farmers shifted from traditional shade plantations to larger, more commercial sun plantations. The program, which began in Guatemala, certifies shade grown coffee with an ECO-O.K. seal of approval and helps producers conserve the natural habitat. The special certification also allows producers to charge a premium in specialty niche markets for environmentally friendly products. Through the Corridor, the program has expanded into El Salvador. Programs like ECO-O.K. are showing coffee producers within the Corridor that they can protect biodiversity while still generating a substantial profit.

Another example of a private corridor initiative in Guatemala is the Cloud Forest Biological Corridor (Corredor Biológico del Bosque Nuboso). This is a relatively new creation that encompasses a forested area. This is a relatively new creation that encompasses a forested area bisecting the Biotopo Mario Dary Rivera and Sierra de Las Minas Biosphere Reserve. Its purpose is to provide an uninterrupted biological corridor for many species of animals living in these protected cloud forests. The corridor covers 28,640 hectares and includes nine communities and eight private reserves.

There are at least another eight corridor initiatives in various stages of development in Guatemala, and all suffer from a need for stronger recognition within existing or new policies that can support and highlight corridor benefits; as well as greater commitment of the human resources, local training, and decentralization of authority that will allow the many partners to implement corridor agreements. The corridor concept may prove to be one of the more cost-effective ways to achieve a well integrated mix of biodiversity conservation objectives across large landscapes. Commitment of the institutional, policy, and financial resources to fulfill these ambitious corridor strategies could prove to be one of the most valuable interventions to mitigate or reduce biodiversity and forest threats. As mentioned in the introductory paragraph for Section 5.3, this commitment can perhaps be most effectively achieved though improved pay scales for civil servants; great job security; advanced training and infrastructure

improvements; and greater communication and coordination between government, NGOs, and private businesses in order to maximize the benefits from very limited financial and technical resources.

5.3.4 GREATER USE OF TRANSBOUNDARY AND REGIONAL INITIATIVES TO ACHIEVE CONSERVATION GOALS

Some of Guatemala's pressing biodiversity and forest conservation needs may be best approached through collaborative, mutually supportive initiatives that bring together institutions from neighboring countries. Transboundary conservation creates a process of collaboration across national, state, or other political borders that can increase the effectiveness of natural resource management (NRM), and cultural or biological conservation by applying a landscape perspective to planning and decision-making. Transboundary conservation areas (TBCAs) allow managers to maximize the benefits of limited financial, physical or human resources by building collaborative natural resource management programs between reserves, protected areas, and surrounding communities (Tolisano et al. 2008). A review of existing literature, analysis of spatial data, and stakeholder consultations suggest that the Guatemala, Mexico, and Belize border region, in particular, could yield significant biodiversity and forest conservation benefits through strengthened transboundary conservation initiatives.

Potential activities could particularly enhance existing management programs within the Maya Biosphere Reserve, Laguna del Tigre, and Maya Mountains–Chiquibul Biosphere Reserve (MMCBR). Initiatives can be developed within existing transboundary agreements and can concentrate on assisting the administration and management teams working within the MBR and MMCBR to fully achieve the ambitious transboundary conservation goals already established for these bi-national reserves. Initiatives can be implemented within the core protected areas and selected sections of the buffer zone of the MBR, with particular attention given to controlling illegal harvests of timber and NTFPs within the core protected areas and existing extractive reserves. It may be most appropriate to implement initiatives through CONAP in Guatemala, the Belize Forest Department (BFD) and Friends for Conservation and Development in Belize (FCD), and Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) in Mexico. Consideration should also be given to expand initiatives to address conservation threats and needs in the vicinity of Sarstoon Temash National Park in Belize and adjacent protected areas in Guatemala.

The principal needs and opportunities in the Mexico–Belize–Guatemala border region include technical assistance to strengthen local government, NGO and CBO institutional capacity to administer and manage existing protected areas and reserves, and to implement measures supporting sustainable land and resource use. Particular attention should be given to initiatives that will facilitate shared resources and staff to support administrative oversight within the public sector as a way to maximize benefits from limited resources. The Inter-American Bank) has been one of the most significant supporters of transboundary biodiversity and natural resource conservation and sustainable development in the border region, with several important projects completed and operating in the tri-national region. Many current IDB investments incorporate transboundary conservation elements or are specifically designed as TBCA programs, including the recently completed Master Plan for the Sustainable Development of Lake Petén Itza, and the Program for the Sustainable Development of the Maya Biosphere Reserve. This latter project provides technical assistance to the SECP and the coordinating unit within the Ministry of Finance to develop geographic information system capabilities to support land use planning, monitoring, and management objectives within the MBR. In late 2006, the IDB approved a $30 million loan to Guatemala for the Multi-Phased Program for the Sustainable Development of the Maya Biosphere Reserve. This initiative builds from the results of the earlier Lake Petén Itzá project and provides loan resources to help MARN and CONAP finance a highly participatory management strategy for the protected areas and buffer zones in the Petén. A complementary project of the Global Environmental Facility could provide an additional $4.1 million in grant funds to finance technical assistance, training

and investments in projects to strengthen protected area management, and improve economic benefits to local communities living in and adjacent to protected areas.

The IDB has also provided $30 million to finance an upgrade of management, coordination, and cooperation capacities in order to facilitate shared management of the Maya forest ecosystem among the countries of Belize, Guatemala, and Mexico, and strengthen the conservation and sustainable use of biodiversity in the MBR. Its specific aims are to : (a) strengthen the institutional mechanisms necessary for the efficient and participatory management of the MBR; (b) stimulate the sustainable uses of biological resources; (c) support the implementation of policies, norms and other management instruments; (d) build tri-national capacities for controlling illegal trafficking in flora and fauna, and capacities for the joint management of environmental contingencies, particularly forest fires; (e) build ecological connectivity in the Maya forest via biological corridors; and (f) enhance biodiversity monitoring and information management systems in the Maya forest. The implementation of the IADB project is under the jurisdiction of the MARN, with the participation of CONAP.

The IDB's recently approved Maya Biosphere Reserve Environmental Services Program will implement a payment for environmental services scheme as an integral part of the sustainable forest management practices of the forest communities in the multiple use zone of the Maya Biosphere. The project is being executed with The Rainforest Alliance.

Many of the larger international environmental NGOs are also very actively promoting conservation and sustainable development in the tri-national border region. For example, WCS carries out training and technical assistance with communities in and adjacent to several of the protected areas in the eastern border region of Guatemala and Belize to strengthen community-based monitoring.

In October of 2005, the GEF and the IDB approved a $9.5 million financing package to support the implementation of an Integrated Management Plan for the Montecristo Trinational Protected Area. (MTPA) in the Trifinio region of Guatemala, El Salvador, and Honduras. The project aims to integrate presently uncoordinated watershed management and biodiversity conservation efforts in the territories of each of the three countries into a single framework. The establishment of the MTPA will be the first tri-national protected area in the Americas under a single administrative unit, a single management plan and under a single budget. In the initial stages of this three-year project, a high priority is to connect the MTPA with important neighboring protected areas in each of the three countries. By strategically connecting fragmented ecological zones of the Trifinio Region, the MTPA Project would lay the groundwork for an ecosystem-based management framework for the region, as well as its integration into the broader framework of the Mesoamerican Biological Corridor. While the project has met with considerable criticism of its top-down approach, it still represents an important set of lessons learned for similar transboundary and regional initiatives.

5.3.5 MITIGATION AND ADAPTIVE RESPONSES TO CLIMATE CHANGE

USAID/Guatemala has proposed the development of a Climate Change Vulnerability and Adaptation workshop in 2010 to identify specific short- and long-term threats and propose mitigative and adaptive responses. The workshop will help anticipate climatic variability and change while designing resilience into development assistance, and can lead to more robust projects that serve their target populations better. In some cases, projects may not be designed to cope adequately with current climate variability. This creates the risk that services provided will be inadequate or that projects will become obsolete prematurely. However, USAID's Global Climate Change Team, in the Bureau for Economic Growth, Agriculture and Trade (EGAT), has developed an analytical process that can help projects and programs anticipate these risks and incorporate measures to minimize or mitigate them. The Global Climate Change Team has been working to address the causes and effects of climate change since 1991. USAID has funded programs that have reduced growth in GHG emissions while promoting energy efficiency,

forest conservation, biodiversity, and other development goals, and the lessons learned from this work inform USAID's vulnerability and adaptation assessment process (USAID 2007).

USAID's approach for assessing vulnerability and identifying and implementing climate change adaptations (the vulnerability and adaptation, or V&A, approach) follows a developmental path parallel to the more general project cycle. The process includes screening for climate vulnerability during the problem diagnosis phase; identifying potential adaptive responses that can be included in the project design phase, and establishing action plans for these responses; implementing adaptive responses; and monitoring results. USAID/Guatemala can consider the development of V&A workshops to strengthen the outputs from its own program portfolio, and providing workshop services to Government of Guatemala agencies and NGOs to enhance their own project initiatives.

5.4 REDUCED POVERTY AND IMPROVED LAND USE THROUGH GREATER ENGAGEMENT OF CIVIL SOCIETY IN BIODIVERSITY AND FOREST CONSERVATION

Improving institutions is not only about improving policies, legal frameworks, and public agencies. It is also about building citizen engagement and voice. Voice and citizen participation are essential tools for sustainable development. Guatemala's responses to biodiversity and forest threats can be strengthened through measures that enhance the engagement of civil society and private business groups in conservation. These measures hold the potential to significantly foster greater community commitment to conservation practices, which in turn strengthens their ability to develop effective natural resource-related enterprise activities. Through these and other efforts, decentralization is strengthened and community empowerment enhanced. Social accountability mechanisms, in turn, become powerful tools to improve government performance to protect and manage the environment and natural resources by enhancing transparency and information disclosure.

5.4.1 PROMOTE PUBLIC PARTICIPATION IN THE ENVIRONMENTAL AGENDA

While improvements to legislative oversight and administrative mechanisms are important to mobilize a coordinated and collaborative national response to biodiversity and forest threats, they also require increased citizen and stakeholder engagement. Greater citizen involvement can be facilitated by disclosing data on biodiversity and forest threats and trends, enabling public review of proposed laws and regulations, and enhancing spaces and opportunities for citizen and civil society participation in the development and implementation of conservation agendas. Participatory methods such as the use of trained para-biologists from CBOs to expand data collection and analysis and resource use monitoring can then be used by the public to hold policymakers accountable, thus enhancing both public sector accountability and performance.

5.4.2 STRENGTHENING CBO PARTICIPATION BY REPLICATING THE FOREST CONCESSION MODEL

During the 1990s, Guatemala placed approximately 500,000 has of forest in the Petén region under more than 12 community-managed concessions. Although corruption and incapacity have been a problem, and some concessions suffer from weak community organization, the enterprises that have emerged within the concessions have largely been profitable. Almost all of the forest management operations in the concessions are certified by the FSC and deforestation rates within the concession areas appear to be considerably lower than outside of them or even in the adjacent protected areas (Chomitz 2007). Some of the concession areas are increasingly plagued by the challenges of operating in a largely unregulated environment with an enormous presence of drug traffickers and other criminal activity. These CBO and forest industry concessions are also struggling to endure the financial impacts from the recent economic downturn, and declining prices and reduced demand are straining the management demands of these

groups. However, despite these challenges the results from the community concession program now provide an important set of lessons learned that can be used to replicate this model in other parts of Guatemala where social, institutional, and ecological conditions can justify a similar approach for engaging civil society and business in public-private partnerships for biodiversity and forest conservation.

Economic returns to communities practicing externally certified, low-impact harvesting in concessions in the northeastern Petén demonstrate that community-based forest management can be profitable, particularly if supported by government policy and technical assistance in forest business management and administration. The results observed in the concession areas in the eastern section of the MBR are in sharp contrast to the western and northern sections of the biosphere reserve where most of area is in various forms of national protected status and there are few concessions. Deforestation due to colonization, illegal activities, and wildfires continues at alarming rates in these areas.

Community concession holders often have previous experience with forest enterprise activities. As mentioned in section 4.2.1, most have been historically involved with the collection and sale of *chicle* and *xate*. They have also been quick to develop working relations with local wood processors and links with international markets. Eight communities that received USAID support have worked through the certification process, and even though not all have obtained FSC certification, the experience has improved their organizational capacity to manage the forest. The training and guidance the concessionaires have received, combined with the secure access to the forest provided through legally recognized, long-term leases, has helped establish sound biodiversity and sustainable forest management practices. In general, the transfer of well-stocked forest from industrial concessions to community enterprises has provided the equity necessary to jumpstart production activities. The communities' ability to generate jobs and timber sales has enabled them to make needed investments in harvesting and processing equipment to add value (Clausen et al. 2000).

There are also considerable lessons learned from the forest concessions that can enhance policy, monitoring, and regulatory responses to conservation threats. For example, in a number of community concessions, including that of Carmelita, there has been a reduced incidence of forest fires. Satellite images and ground observations indicate that unlike the adjacent national park the number of forest fires has greatly been reduced in the concession area over the past years. However, in the multiple use zone of the MBR, each management unit requires a plan for the prevention and control of forest fires, including monitoring and patrol programs, a system of fines for those responsible for fires, the organization of brigades, fire fighting strategies, training of personnel, and acquisition of fire extinguishing equipment. These policies and resources have not been adequately assigned within the parks, and the lessons learned from the concessions could serve as a model to strengthen protected area integrity (Stoian and Rodas 2006).

5.4.3 STRENGTHENED MANAGEMENT AND ADMINISTRATIVE SKILLS IN PRODUCER GROUPS

Experience with the forest concessions in the Petén region, and similar USAID initiatives implemented through such projects as BOLFOR in Bolivia, do indicate the risks inherent in engaging remote and often poorly educated communities in biodiversity and forest conservation efforts. Not all management activities can or should be internalized within CBOs or private businesses. Experience has demonstrated the essential need for training, technical assistance, and infrastructure development. For example, outsourcing certain forest management and market functions within the forest concessions in the Petén has proven to be advantageous, such as was done in the case of using third party certification. Building local capacity to not only manage forestry resources under certification, but also to professionally administer these complex and ever-evolving certification programs can reduce costs and increase market access for remote resource users.

One option that is already being implemented through USAID/Guatemala financed programs with Rainforest Alliance and Counterpart International is to establish a national service provider to serve as a source of technical information assembled to guide the development of natural resource-based businesses. In some cases, the provider is structured as a government, parastatal or civil society organization offering public awareness, education, and training services designed to assist CBOS and businesses to identify marketable ecosystem products and services; produce triple bottom line assessments of product and service development scenarios;[2] improve producer access to markets, strengthen small business management and administration skills and tools, and perhaps serve as a venue for the delivery of competitive grants and loans to support sustainable resource use business start-ups and expansions.

5.4.4 LEGALIZATION AND TITLING OF LANDS IN AND ADJACENT TO PROTECTED AREAS

In section 4.5.4 the impact from a large in-migration of people into the Petén region was highlighted to demonstrate the threats to biodiversity and forest cover that can result from unregulated population grown and migration. However, as discussed in section 5.4.2 above, the contrast between land-use characteristics and environmental conditions in the recently settled parts of the MBR in comparison with those of established legally titled communities is striking. CBOs with secure tenure (principally in the eastern sectors), and that have obtained technical assistance in managing sustainable natural resource-based businesses, are rapidly developing forest industries. Field observations of environmental conditions suggest that many of these CBOs and industry operated concessions are managing the forests in what appears to be a more sustainable manner. Deforestation is minimal and forestry practices are well monitored.

In the western zone, where more of the land is in national protected areas (primarily national parks), the surrounding settlers are practicing extensive and destructive slash-and-burn agriculture. Encroachment into the protected areas is common and forests adjacent to all the main access routes are being liquidated at rapid rates. While the insecurity resulting from widespread drug trafficking adds considerably to this problem, as described in Section 4.1.6, there is some indication that allocating secure tenure rights and providing technical support for community-based forest management is producing more significant and enduring benefits for conservation and livelihoods in forest areas outside of direct government management, while the protected area system in other parts of the Petén is being severely degraded.

A national effort to once again replicate the lessons learned in the Petén could provide significant benefits for biodiversity and forest conservation. Improving legalization and titling of lands and resources should be tied closely with the opportunities for strengthening environmental information systems described in Section 5.3.1 above. In particular, creating a cadre of training local para-technicians with the capacity to carry out ground truthing of spatial data analyses should be an essential ingredient in any title and legal certification processes.

Legalization and titling of lands will not resolve all threats to biodiversity and forests in Guatemala. However, it can significantly strengthen stakeholder commitment to land and resources and provide them with critically important legal and financial incentives to sustain the ecosystem integrity of the terrain under their jurisdiction.

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[2] Triple bottom line accounting means expanding the traditional reporting framework to take into account ecological and social performance in addition to financial performance.

5.4.5 DIRECT INTERVENTIONS IN ECOSYSTEM PROTECTION

Unmanaged forest and pasture fires represent one of the more significant threats to habitat in Guatemala, and represent particularly significant threats in protected areas. The National System for the Prevention and Control of Forest Fires (SIPECIF) has been formed to assume responsibility for preventing and controlling unmanaged fires. Some of the leading SIPECIF strategies proposed to reduce or avoid this threat include the following:

- Increase the number of forest and park guards employed within NGO, CBO, private business, and municipal agencies, and provide training and equipment in controlled burn strategies to reduce impacts from excessively hot fires, and fire control mechanisms
- Implement broad-scale public awareness and education programs to prevent unmanaged fires[3]
- Organize, train, and equip voluntary fire brigades in areas of high fire risk and occurrence

Unfortunately, SIPECIF continues to suffer from insufficient human resources and operating funds, and does not yet have the presence in rural areas required to effectively respond to the magnitude of the threat represented by uncontrolled fires.

At the same time, several national and international NGOs, particularly WCS, FDN, TNC, and RA, have begun to devote considerable resources towards monitoring threats from fires and advancing improved prevention and detection measures. Significant benefits could be realized by ensuring greater collaboration between government and NGO fire prevention, detection and control efforts, and building the infrastructure capacity to respond before fires reach uncontrollable stages.

5.4.6 RESTORATION OF DEGRADED HABITATS

The PINFOR program of INAB provides a promising example of financial and technical measures that can significantly increase tree cover on formerly degraded lands. Increased tree cover has unquestionably provided very valuable social, economic, and environmental benefits for local communities. However, important benefits can be gained for biodiversity through similar and perhaps even more ambitious efforts to restore native habitats throughout Guatemala. Some of the actions that could rapidly advance efforts to recover degraded or fragmented habitat include the following:

- Apply results produced in a recent ecological gap assessment to prioritize habitats at greatest risk and identify the specific threats facing each – a great deal of the data required to complete this task is readily available, though dispersed among CECON, MAGA, and the national and international NGO community.
- Create financial incentives through small grant competitions operated within municipal governments for the establishment of pilot restoration programs for selected habitats on private and community-managed properties.
- Significantly advance the promotion of sustainable agriculture practices that incorporate habitat improvements for non-pest species, particularly on lands adjacent to protected reserves.
- Develop broad-scale restoration initiatives in degraded areas within existing protected areas.

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[3] Previous USAID/Guatemala experience in the Petén region suggests that areas with greater stakeholder involvement show a significant reduction in the incidence of human-induced fires, and this prevention is achieved at a significant cost savings over the expenses required to detect and extinguish fires.

6. USAID OPPORTUNITIES TO STRENGTHEN THE CONSERVATION OF BIODIVERSITY AND TROPICAL FORESTS IN GUATEMALA

Section 4 of this assessment identified threats to biodiversity and forest conservation in Guatemala, including some of the underlying social, economic, and institutional factors driving the threats. Section 5 of the assessment identified opportunities that could potentially mitigate, reduce or help avoid threats through direct or indirect interventions. This section of the assessment summarizes some of the recent USAID interventions in biodiversity and forest conservation, and provides a menu of options for future interventions that could respond to specific threats. The menu of options uses the cumulative threat analysis produced in section 4.6 to indicate specific opportunities that can respond to each identified threat. The menu of options is designed to serve as a guide that can help plan, target and prioritize future interventions.

6.1 USAID INTERVENTIONS IN BIODIVERSITY AND FOREST CONSERVATION

In recent years, USAID's environment program in Guatemala has supported environmentally sound management of natural resources in several priority areas of great biodiversity, including the MBR in the Petén, the Motagua-Polochic system (which includes the Sierra de las Minas Biosphere Reserve), and the Atitlán Volcanoes Bioregion. USAID's program also provided assistance to develop sustainable income generation alternatives to people living in and around protected areas. These include efforts to establish carbon credit initiatives, certify timber production, control forest fires, develop non-traditional forest products, encourage tourism, and promote environmentally sound production practices. The following sections provide a concise summary of some of these interventions.

6.1.1 NATURAL RESOURCES MANAGEMENT AND CONSERVATION OF CARBON STOCKS

USAID support has contributed to conservation in the MBR through interventions that have brought a half million forested hectares under FSC certification. This initiative demonstrates an important alliance between the Guatemalan public sector and the forestry concessionaries, both to communities and the two industry concessions, located in the Multiple Use Zone of the MBR. In order to prepare Guatemala for participation in global carbon credit market schemes, Rainforest Alliance completed an analysis of carbon credit potential in various forest ecosystems in 2007.

In addition to the direct environmental benefits, significant economic gains have already been realized. In fiscal year 2007, 2.6 million board feet of certified and forest products in "process of certification" were sold for $5.1 million. USAID supported the consolidation of business links between certified timber producers and buyers and helped develop incentives for certified forest management and chain of custody tracking. Additionally, USAID helped open important markets for *xate*, a non-timber forest foliage product.

6.1.2 SUSTAINABLE TOURISM

Sustainable tourism supports the maintenance of stable populations, conservation of biodiversity, and sustenance of critical wildlife species. USAID supported the Geotourism Initiative that consists of a Geotourism Charter signed by the National Geographic Society, the Government of Guatemala, and the private sector, to sustain and enhance the environment and the diversity of the cultural, historic, and scenic assets of Guatemala. USAID promoted the certification of 30 new SMEs and community-based operations under the Green Deal certification seal and supported the marketing of certified venues. USAID also helped to improve various web portals and the design of fact sheets for 13 tourism destinations. Also in 2007, 1,118 people (including 602 women) received increased economic benefits from sustainable tourism. USAID granted four scholarships to women to participate in a formal community tourism education program. The handicrafts component of this program helped women's groups to legalize their organizations and also provided technical assistance on new market trends.

This project builds upon past accomplishments; in previous years, USAID has funded projects to install tourist infrastructure, train park staff in municipal parks administration, and help leverage financial resources to build trails, a visitor center, and a geology museum in Atitlan. In San Marcos and San Juan municipalities in Solola, park boundaries were mapped and delimited, and best management practices for sustainable land use were developed. All these elements served as inputs to develop natural resource management plans.

6.1.3 FOREST FIRE PREVENTION AND CONTROL

Reducing forest fires and forest fire threats is a key focus of USAID/Guatemala's assistance in the Petén region where, in 2005, 375,000 hectares (nearly 1/5th of the MBR) burned during the fire season. USAID support has equipped and trained municipal fire brigades in all seven municipalities of the region, and national and international NGOs working in the area have begun to increase their attention on the need to prevent unmanaged firest. For example, the national NGO Defensores de La Naturaleza is actively engaged in fire prevention through the use of fire breaks, conducting prescribed burns, and establishing voluntary brigades to conduct patrols and monitoring activities in the Sierra del Lacandon and Sierra de las Minas protected areas and buffer zones. In addition, USAID is funding direct fire suppression activities through the provision of training, equipment, and transportation, as well as a strong prevention component through public outreach and community patrolling in high risk areas.

6.1.4 CROSS SECTOR OPPORTUNITIES

The USAID/Guatemala Mission is implementing or proposing several projects and programs that cut across its three sectors[4] and hold the potential to provide direct or indirect contributions to the conservation of biodiversity and forests in Guatemala. The Office of Enterprise, Trade and the Environment (OETE) is operating under a Strategic Objective (SO) of "Economic Freedom: Open, Diversified, Expanding Economies", with three Intermediate Results (IRs):

- **IR 1:** Laws, policies and regulations that promote trade and investment
- **IR2:** More competitive, market oriented private enterprises
- **IR3:** Broader access to financial markets and services

As one example of cross-cutting initiatives that contribute to conservation concerns, the OETE's Value Chains Program works with funds that come from agriculture, competitive trade, and the environment,

[4] The Office of Enterprise, Trade and Environment; Democracy and Governance; and Health and Education

with approximately U.S. $15 million committed from 2006 to 2010. The program provides technical assistance and training in sustainable agriculture practices, enterprises, and manufacture, with indirect benefits to biodiversity conservation through improved land uses and sustainable enterprise development.

The USAID/Guatemala Office of Health and Education develops projects designed to strengthen human resources in the country, under the SO of Investing in People: Healthier Better Educated People. The Health and Education SO aims to achieve the following IRs:

- **IR 1:** Increased and Improved Social Sector Investments at the National and Local Levels
- **IR 2:** Improved Quality and Equity of Basic Education
- **IR 3:** Improved Nutrition and Reproductive and Maternal Child Health Care
- **IR4:** Contained and Mitigated Impact of HIV/AIDS

The Health and Education office is carrying out a wide range of programs to meet this objective, several of which could produce benefits for the conservation of biodiversity and forests. For example, the "Alianzas for Health Education and Nutrition" program is carrying out activities designed to rehabilitate water and sanitation systems and reduce the contamination of water supplies. This program also includes a strong education component that could be expanded to embrace concepts that demonstrate the wider ecological benefits of improved water quality for local and regional biodiversity. The program "Strengthening Pharmaceutical Systems" includes training and capacity building for hospital and health care workers to improve waste management practices in health facilities in order to reduce the dispersal of infectious diseases in surrounding environments. The management of these wastes can have a direct impact on biodiversity through reduced contamination of soils and surface and ground water supplies. However, this program will be completed by September 2010.

The Democracy and Governance Office of USAID/Guatemala includes eight programs directed at improving the rule of law, strengthening municipal governments, reducing corruption and enhancing transparency in public affairs, preventing juvenile crime, improving human rights, assisting returned migrants, institutional and technical assistance in electoral policies, and strengthening the capacity of the National Civil Police. While opportunities exist in several of these programs to enhance the capacity of public servants to administer and manage biodiversity and forest conservation mandates, the activities being implemented to improve the rule of law specifically include measures designed to enhance environmental concerns. For example, USAID is assisting actions to strengthen the Public Ministry in the Petén and specifically enhance the management of financial resources allocated for environmental management. These activities are being coordinated with assistance being provided through the U.S. Department of the Interior to support training to local magistrates, and can also include measures to improve the enforcement of environmental laws and mandates.

USAID/Guatemala is also participating in at least two regional programs with strong implications for the conservation of biodiversity and forests. USAID's Regional Program for Central America and Mexico (USAID/E-CAM) will award a five-year Task Order under the Water II IQC for the implementation of a regional coastal and marine conservation initiative in Latin America and the Caribbean. The forthcoming Management of Aquatic Resources and Economic Alternatives (MAREA) regional program will include strategic and geographically focused efforts to foster public/private partnerships; invest in a variety of conservation interventions, including the development and strengthening of marine protected areas; explore opportunities to leverage USAID and other donor investments for coastal and marine conservation; and focus on issues of equity, fisheries overexploitation, and fisheries-related livelihoods. The program can play a valuable role in promoting the adoption and implementation of an ecosystem-based approach to fisheries management in the region. The program

can also include measures to reduce the impacts from climate change, including activities to build resilience to ocean acidification and conservation of mangroves and coral reefs.

USAID has worked previously in coastal marine resources through the Central American Regional Environmental Program Coastal Component – PROARCA/COSTAS (2003 – 2007). This project was designed to promote coastal-marine conservation in the Central American region and provided technical assistance using methodologies and principles of integrated coastal zone management, strongly based on field experiences. PROARCA/COSTAS worked regionally to assist policies that would strengthen the Central American agenda for the conservation of coastal-marine resources, as well as in the field in transboundary zones identified as priority sites, for their biological and geopolitical importance. The MAREA program will build from these previous experiences and lessons learned.

The USAID/Guatemala mission will also support and complement bilateral efforts under the Central America and Mexico (CAM) Strategy, as well as the Environment Cooperation Agreement under the Dominican Republic (DR)-Central American Free Trade Agreement (CAFTA) and the Joint Declaration Central America and United States of America (CONCAUSA). The regional initiatives will produce results in each of the following areas:

- Institutional Strengthening for Effective Implementation and Enforcement of Environmental Laws
- Biodiversity and Conservation
- Market-based Conservation
- Improved Private-Sector Environmental Performance;
- Implementation of Specific Obligations under DR-CAFTA.

A wide array of expected results has been identified for each of these themes, many of which can produce important benefits for biodiversity and forest conservation. For example, the Policy efforts will focus on ensuring close cooperation with OSPESCA, CCAD, and national agencies to ensure an appropriate enabling environment within the GoG sectors responsible for biodiversity and forest conservation. U.S. Government departments and agencies and international and non-governmental organizations are also working with DR-CAFTA governments and civil society to prevent species trade that violates international standards, including CITES. U.S. cooperation also aims to better protect and manage forest resources and protected areas. Through environmental cooperation, the DR-CAFTA countries are strengthening scientific and institutional capacity of their CITES authorities, training officials responsible for implementation of CITES, building intelligence networks, building and supporting animal rescue centers, preventing illegal logging, and promoting the sustainable use of wildlife and protected areas. Market-based conservation initiatives are focused on expanding and strengthening ecotourism operations, sustainable agriculture, forestry, and fisheries.

6.2 INTERVENTION OPPORTUNITIES

A wide variety of options exists for every sector of the USAID/Guatemala mission to participate in the mitigation, reduction or avoidance of the principal threats to biodiversity and forest conservation in Guatemala. Some of these potential responses can follow directly from previous and ongoing USAID initiatives, and others can serve as natural out-growths from other national and regional efforts. Many of the potential responses can also be developed in an integrative manner across the three Mission sectors. The following summaries are not intended to recommend specific interventions, each of which would require more substantial social, economic, and institutional assessments in order to determine geographic priorities; cost/benefit analyses; time frame scales, appropriate partners; and risks. However, the

summaries are designed to identify topical areas within which possible interventions can be framed and discussed with national and local counterparts, and from which specific regional, national or site-based initiatives can be defined. The topical areas are identified for each threat identified in Section Four of this assessment, and are tied to the biodiversity and forest conservation opportunities identified in Section Five.

It is also not the intention of this assessment to suggest that each threat should be treated individually. It is likely that the most powerful interventions will combine the suggested mitigations for each threat into one or more initiatives that respond to many threats simultaneously, and possibly to engage multiple sectors within the mission. USAID/Guatemala and its partners are encouraged to look for every opportunity to produce responses that can achieve a reduction or mitigation of multiple threats with well coordinated and integrated actions.

Threat: Climate Change	
Drivers – Obstacles to Threat:	**Opportunities to Mitigate or Reduce Threat:**
• International and national GHG emissions • Poorly managed forest product harvests • Lack of coordinated land and resource use planning and management • Unregulated human population growth and migration	• Carrying out a Vulnerability & Adaptation workshop to identify threats and propose mitigation responses • Providing capacity building and training to strengthen government, NGO, and business institutional capacity to understand and manage water or natural resources in the context of climate vulnerability • Building business skills in private and community-based natural resource enterprises • Payment for ecosystem service programs, particularly forest-based carbon emission reduction programs, renewable energy, and energy conservation programs • Expansion of the forest concession concept • Strengthening institutional coordination in biodiversity and forest conservation • Improved monitoring and decision-making with strengthened environmental information systems • Developing adaptive response mechanisms, particularly in municipal governments and CBOs, to prepare for gradual ecosystem changes, particularly in coastal areas

Threat: Habitat Loss, Degradation and Fragmentation – Conversion of Forest Lands to Agriculture	
Drivers – Obstacles to Threat:	**Opportunities to Mitigate or Reduce Threat:**
• Lack of economic opportunities • Ineffective monitoring and enforcement • Unregulated population growth and migration • Lack of verified land titles	• Expansion of the forest concession concept to other areas throughout Guatemala • Private and community-based natural resource enterprises • Payment for ecosystem service programs • Land titling and verification • Improved land use regulation • Strengthening administrative and management skills in producer groups • Building capacity to link producers to markets • Strengthened monitoring and enforcement, particularly by empowered municipal, CBO, and private sector groups

Threat: Over-exploitation – Marine Resources	
Drivers – Obstacles to Threat:	**Opportunities to Mitigate or Reduce Threat:**
• Pervasive poverty and lack of economic opportunities • Weak environmental management institutions • Inadequate or ineffective policies • Lack of coordinated land and resource use planning and management	• A unifying national policy that identifies risks, monitoring and enforcement needs for coastal and marine ecosystems • Improved monitoring and decision-making with strengthened environmental information systems • Improved land and marine resource use regulation • Development of transboundary conservation initiatives to maximize the benefits of limited financial, physical or human resources by building collaborative natural resource management programs between reserves, protected areas, and surrounding communities • Strengthening CBO participation by replicating the forest concession model in coastal and marine areas • Strengthening management and administrative skills in producer groups

Threat: Habitat Loss, Degradation and Fragmentation – Fire	
Drivers – Obstacles to Threat:	**Opportunities to Mitigate or Reduce Threat:**
• Weak environmental management institutions • Inadequate or ineffective policies • Lack of coordinated land and resource use planning and management • Unregulated human population growth and migration	• Expansion of the forest concession concept, particularly to strengthen land titling and build local monitoring and enforcement capacity • Private and community-based natural resource enterprises • Payment for ecosystem service programs • Improved land use regulation • Increasing the number of forest and park guards employed within NGO, CBO, private business, and municipal agencies, and providing training and equipment in controlled burn strategies to reduce impacts from excessively hot fires, and fire control mechanisms • Implementing broad-scale public awareness and education programs to prevent unmanaged fires • Organizing, training, and equipping voluntary fire brigades in areas of high fire risk and occurrence

Threat: Habitat Loss, Degradation and Fragmentation – Exotic or Invasive Species	
Drivers – Obstacles to Threat:	**Opportunities to Mitigate or Reduce Threat:**
• Unmanaged fires • Land conversion for agriculture • Land conversion for mineral and petroleum development • Environmental contamination from poorly managed liquid, solid and atmospheric wastes • Lack of coordinated land and resource use planning and management	• Biodiversity offsets to mitigate or restore degraded habitat • A unifying national policy to identify threats and establish standards, regulatory mechanisms and mitigation requirements • Improved monitoring and decision-making to identify exotic or invasive species of high concern, and areas of particular risk • Transboundary initiatives that promote regional collaboration to reduce exotic species transport and dispersal

Threat: Habitat Loss, Degradation and Fragmentation – Drug Trafficking	
Drivers – Obstacles to Threat:	**Opportunities to Mitigate or Reduce Threat:**
• Pervasive poverty and lack of economic opportunities • Weak environmental management institutions • Inadequate or ineffective policies • Lack of coordinated land and resource use planning and management • Unregulated human population growth and migration • Lack of verified land titles	• Increased presence of government and civil society organizations in trafficking areas • Institutional coordination • Strengthened use of spatial data to monitor changes in ecosystems and forest cover • Developing a national accounting system assigning monetary values to environmental services and resources, particularly those found in forested watersheds and marine ecosystems, and specifically including values for carbon, water, and biodiversity • Developing rural business and CBO capacity to plan and implement sound micro and small-scale enterprise development programs; • Forest-based carbon emission reduction projects • Biodiversity offset projects to compensate landowners for protected habitat • Transboundary conservation initiatives in border regions • Greater CBO and private business participation in conservation by replicating the forest concession model • Legalization and titling of lands

Threat: Over-exploitation – Forest Products	
Drivers – Obstacles to Threat:	**Opportunities to Mitigate or Reduce Threat:**
• Land conversion for agriculture • Land conversion for mineral and petroleum development • Drug trafficking • Pervasive poverty and lack of economic opportunities • Weak environmental management institutions • Inadequate or ineffective policies • Lack of coordinated land and resource use planning and management • Unregulated human population growth and migration • Lack of verified land titles	• Developing a national accounting system assigning monetary values to environmental services and resources, particularly those found in forested watersheds, and specifically including values for carbon, water, and biodiversity • Building business skills in private and community-based natural resource enterprises • Payment for ecosystem service programs, particularly forest-based carbon emission reduction programs • Expansion of the forest concession concept • Strengthening institutional coordination in biodiversity and forest conservation • Improved monitoring and decision-making with strengthened environmental information systems • Strengthening administrative and management skills in producer groups • Building capacity to link producers to markets • Legalization and titling of lands

Threat: Over-exploitation – Hunting	
Drivers – Obstacles to Threat:	**Opportunities to Mitigate or Reduce Threat:**
• Land conversion for agriculture • Land conversion for mineral and petroleum development • Drug trafficking • Pervasive poverty and lack of economic opportunities • Weak environmental management institutions • Inadequate or ineffective policies • Lack of coordinated land and resource use planning and management • Unregulated human population growth and migration • Lack of verified land titles	• Increased presence of government and civil society organizations in trafficking areas • Institutional coordination to delegate responsibility and resources to local government and NGOs to enhance the monitoring and enforcement • Improved monitoring and decision-making with strengthened environmental information systems • Empowering trained para-biologists from CBOs to expand monitoring and enforcement

Threat: Over-exploitation – Wildlife Trafficking	
Drivers – Obstacles to Threat:	**Opportunities to Mitigate or Reduce Threat:**
• Land conversion for agriculture • Land conversion for mineral and petroleum development • Drug trafficking • Pervasive poverty and lack of economic opportunities • Weak environmental management institutions • Inadequate or ineffective policies • Lack of coordinated land and resource use planning and management	• Increased presence of government and civil society organizations in trafficking areas • Institutional coordination to delegate responsibility and resources to local government and NGOs to enhance the monitoring and enforcement • Improved monitoring and decision-making with strengthened environmental information systems • Empowering trained para-biologists from CBOs to expand monitoring and enforcement

Threat: Environmental Contamination and Degradation	
Drivers – Obstacles to Threat:	**Opportunities to Mitigate or Reduce Threat:**
• Pervasive poverty and lack of economic opportunities • Weak environmental management institutions • Inadequate or ineffective policies • Lack of coordinated land and resource use planning and management • Unregulated human population growth and migration	• Water banking systems • Biodiversity offsets to provide funding for waste management and mitigation • Coordinate agricultural and forest policies to reduce land use conflicts • Strengthened institutional coordination • Improved land and marine resource monitoring and enforcement; • Restoration of degraded habitats

Threat: Habitat Loss, Degradation and Fragmentation – Road Construction	
Drivers – Obstacles to Threat:	**Opportunities to Mitigate or Reduce Threat:**
• Land conversion for agriculture • Land conversion for mineral and petroleum development • Lack of coordinated land and resource use planning and management • Unregulated human population growth and migration	• Biodiversity offsets to compensate for lost or degraded habitat • A unifying national policy that recognizes the impacts of poorly planned roads on habitat alterations • Strengthening technical capacity of responsible staff of MARN/CONAP in reviewing/approving EIAs • Strengthening institutional coordination • Coordinating and consolidating data and mapping to maintain updated and verifiable delineations of proposed road improvements and construction in relation to critical habitat areas • Providing technical standards, technical assistance, and training to improve municipal government performance in monitoring • Coordination of road improvements in transboundary and regional initiatives • Legalization and titling of lands • Restoration of degraded habitats

Threat: Habitat Loss, Degradation and Fragmentation – Mineral and Petroleum Development	
Drivers – Obstacles to Threat:	**Opportunities to Mitigate or Reduce Threat:**
• Weak environmental management institutions • Inadequate or ineffective policies • Lack of coordinated land and resource use planning and management	• Biodiversity offsets to compensate for lost or degraded habitat • A unifying national policy that incorporates biodiversity and forest conservation with exploration and extraction protocol • Strengthening institutional coordination • Improving monitoring and decision making systems • Restoration of degraded habitats

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ANNEX I. SECTIONS 117, 118 AND 119 OF THE U.S. FOREIGN ASSISTANCE ACT

COMMITTEE ON INTERNATIONAL RELATIONS

COMMITTEE ON FOREIGN RELATIONS

Legislation on Foreign Relations Through 2002

JULY 2003

VOLUME I–A OF VOLUMES I–A AND I–B

CURRENT LEGISLATION AND RELATED EXECUTIVE ORDERS

U.S. HOUSE OF REPRESENTATIVES

U.S. SENATE

Sec. 117.[95] **Environment and Natural Resources.**—(a) The Congress finds that if current trends in the degradation of natural resources in developing countries continue, they will severely undermine the best efforts to meet basic human needs, to achieve sustained economic growth, and to prevent international tension and conflict. The Congress also finds that the world faces enormous, urgent, and complex problems, with respect to natural resources, which require new forms of cooperation between the United States and developing countries to prevent such problems from becoming unmanageable. It is, therefore, in the economic and security interests of the United States to provide leadership both in thoroughly reassessing policies relating to natural resources and the environment, and in cooperating extensively with developing countries in order to achieve environmentally sound development.

(b) In order to address the serious problems described in sub-section (a), the President is authorized to furnish assistance under this part for developing and strengthening the capacity of developing countries to protect and manage their environment and natural resources. Special efforts shall be made to maintain and where possible to restore the land, vegetation, water, wildlife, and other re-sources upon which depend economic growth and human well-being, especially of the poor.

(c)(1) The President, in implementing programs and projects under this chapter and chapter 10 of this part,[96] shall take fully into account the impact of such programs and projects upon the environment and natural resources of developing countries. Subject to such procedures as the President considers appropriate, the President shall require all agencies and officials responsible for pro-grams or projects under this chapter—

(A) to prepare and take fully into account an environmental impact statement for any program or project under this chapter significantly affecting the environment of the global commons outside the jurisdiction

of any country, the environment of the United States, or other aspects of the environment which the President may specify; and

(B) to prepare and take fully into account an environmental assessment of any proposed program or project under this chapter significantly affecting the environment of any foreign country. Such agencies and officials should, where appropriate, use local technical resources in preparing environmental impact statements and environmental assessments pursuant to this subsection.

(2) The President may establish exceptions from the requirements of this subsection for emergency conditions and for cases in which compliance with those requirements would be seriously detrimental to the foreign policy interests of the United States.

Sec. 118.[97] **Tropical Forests.**

(a) IMPORTANCE OF FORESTS AND TREE COVER.—In enacting section 103(b)(3) of this Act the Congress recognized the importance of forests and tree cover to the developing countries. The Congress is particularly concerned about the continuing and accelerating alteration, destruction, and loss of tropical forests in developing countries, which pose a serious threat to development and the environment. Tropical forest destruction and loss—

(1) result in shortages of wood, especially wood for fuel; loss of biologically productive wetlands; siltation of lakes, reservoirs, and irrigation systems; floods; destruction of indigenous peoples; extinction of plant and animal species; reduced capacity for food production; and loss of genetic resources; and

(2) can result in desertification and destabilization of the earth's climate. Properly managed tropical forests provide a sustained flow of re-sources essential to the economic growth of developing countries, as well as genetic resources of value to developed and developing countries alike.

(b) PRIORITIES.—The concerns expressed in subsection (a) and the recommendations of the United States Interagency Task Force on Tropical Forests shall be given high priority by the President—

(1) in formulating and carrying out programs and policies with respect to developing countries, including those relating to bilateral and multilateral assistance and those relating to private sector activities; and

(2) in seeking opportunities to coordinate public and private development and investment activities which affect forests in developing countries.

(c) ASSISTANCE TO DEVELOPING COUNTRIES.—In providing assistance to developing countries, the President shall do the following:

(1) Place a high priority on conservation and sustainable management of tropical forests.

(2) To the fullest extent feasible, engage in dialogues and ex-changes of information with recipient countries—

(A) which stress the importance of conserving and sustainably managing forest resources for the long-term economic benefit of those countries, as well as the irreversible losses associated with forest destruction, and

(B) which identify and focus on policies of those countries which directly or indirectly contribute to deforestation.

(3) To the fullest extent feasible, support projects and activities—

(A) which offer employment and income alternatives to those who otherwise would cause destruction and loss of forests, and

(B) which help developing countries identify and implement alternatives to colonizing forested areas.

(4) To the fullest extent feasible, support training programs, educational efforts, and the establishment or strengthening of institutions which increase the capacity of developing countries to formulate forest policies, engage in relevant land-use planning, and otherwise improve the management of their forests.

(5) To the fullest extent feasible, help end destructive slash-and-burn agriculture by supporting stable and productive farming practices in areas already cleared or degraded and on lands which inevitably will be settled, with special emphasis on demonstrating the feasibility of agroforestry and other techniques which use technologies and methods suited to the local environment and traditional agricultural techniques and feature close consultation with and involvement of local people.

(6) To the fullest extent feasible, help conserve forests which have not yet been degraded, by helping to increase production on lands already cleared or degraded through support of reforestation, fuelwood, and other sustainable forestry projects and practices, making sure that local people are involved at all stages of project design and implementation.

(7) To the fullest extent feasible, support projects and other activities to conserve forested watersheds and rehabilitate those which have been deforested, making sure that local people are involved at all stages of project design and implementation.

(8) To the fullest extent feasible, support training, research, and other actions which lead to sustainable and more environmentally sound practices for timber harvesting, removal, and processing, including reforestation, soil conservation, and other activities to rehabilitate degraded forest lands.

(9) To the fullest extent feasible, support research to expand knowledge of tropical forests and identify alternatives which will prevent forest destruction, loss, or degradation, including research in agroforestry, sustainable management of natural forests, small-scale farms and gardens, small-scale animal husbandry, wider application of adopted traditional practices, and suitable crops and crop combinations.

(10) To the fullest extent feasible, conserve biological diversity in forest areas by—

(A) supporting and cooperating with United States Government agencies, other donors (both bilateral and multi-lateral), and other appropriate governmental, intergovernmental, and nongovernmental organizations in efforts to identify, establish, and maintain a representative network of protected tropical forest ecosystems on a worldwide basis;

(B) whenever appropriate, making the establishment of protected areas a condition of support for activities involving forest clearance of degradation; and

(C) helping developing countries identify tropical forest ecosystems and species in need of protection and establish and maintain appropriate protected areas.

(11) To the fullest extent feasible, engage in efforts to in-crease the awareness of United States Government agencies and other donors, both bilateral and multilateral, of the immediate and long-term value of tropical forests.

(12) To the fullest extent feasible, utilize the resources and abilities of all relevant United States Government agencies.

(13) Require that any program or project under this chapter significantly affecting tropical forests (including projects involving the planting of exotic plant species)—

(A) be based upon careful analysis of the alternatives available to achieve the best sustainable use of the land, and

(B) take full account of the environmental impacts of the proposed activities on biological diversity, as provided for in the environmental procedures of the Agency for International Development.

(14) Deny assistance under this chapter for—

(A) the procurement or use of logging equipment, unless an environmental assessment indicates that all timber harvesting operations involved will be conducted in an environmentally sound manner which minimizes forest destruction and that the proposed activity will produce positive economic benefits and sustainable forest management systems; and

(B) actions which significantly degrade national parks or similar protected areas which contain tropical forests or introduce exotic plants or animals into such areas.

(15) Deny assistance under this chapter for the following activities unless an environmental assessment indicates that the proposed activity will contribute significantly and directly to improving the livelihood of the rural poor and will be conducted in an environmentally sound manner which supports sustainable development:

(A) Activities which would result in the conversion of forest lands to the rearing of livestock.

(B) The construction, upgrading, or maintenance of roads (including temporary haul roads for logging or other extractive industries) which pass through relatively undegraded forest lands.

(C) The colonization of forest lands.

(D) The construction of dams or other water control structures which flood relatively undegraded forest lands.

(d) PVOS AND OTHER NONGOVERNMENTAL ORGANIZATIONS.— Whenever feasible, the President shall accomplish the objectives of this section through projects managed by private and voluntary organizations or international, regional, or national nongovernmental organizations which are active in the region or country where the project is located.

(e) COUNTRY ANALYSIS REQUIREMENTS.—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 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.

(f) [98] ANNUAL REPORT.—Each annual report required by section 634(a) of this Act shall include a report on the implementation of this section.

Sec. 119.[99] **Renewable and Unconventional Energy Technologies.** * * * [Repealed—1980]

Sec. 119.[100] **Endangered Species.**—(a) The Congress finds the survival of many animal and plant species is endangered by over-hunting, by the presence of toxic chemicals in water, air and soil, and by the destruction of habitats. The Congress further finds that the extinction of animal and plant species is an irreparable loss with potentially serious environmental and economic consequences for developing and developed countries alike. Accordingly, the preservation of animal and plant species through the regulation of the hunting and trade in endangered species, through limitations on the pollution of natural ecosystems, and through the protection of wildlife habitats should be an important objective of the United States development assistance.

(b) [100] In order to preserve biological diversity, the President is authorized to furnish assistance under this part, notwithstanding section 660,[101] to assist countries in protecting and maintaining wildlife habitats and in developing sound wildlife management and plant conservation programs. Special efforts should be made to establish and maintain wildlife sanctuaries, reserves, and parks; to enact and enforce anti-poaching measures; and to identify, study, and catalog animal and plant species, especially in tropical environments.

(c) [102] FUNDING LEVEL.—For fiscal year 1987, not less than $2,500,000 of the funds available to carry out this part (excluding funds made available to carry out section 104(c)(2), relating to the Child Survival Fund) shall be allocated for assistance pursuant to subsection (b) for activities which were not funded prior to fiscal year 1987. In addition, the Agency for International Development shall, to the fullest extent possible, continue and increase assistance pursuant to subsection (b) for activities for which assistance was provided in fiscal years prior to fiscal year 1987.

(d) [102] COUNTRY ANALYSIS REQUIREMENTS.—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.

(e) [102] LOCAL INVOLVEMENT.—To the fullest extent possible, projects supported under this section shall include close consultation with and involvement of local people at all stages of design and implementation.

(f) [102] PVOS AND OTHER NONGOVERNMENTAL ORGANIZATIONS.— Whenever feasible, the objectives of this section shall be accomplished through projects managed by appropriate private and voluntary organizations, or international, regional, or national non-governmental organizations, which are active in the region or country where the project is located.

(g) [102] ACTIONS BY AID.—The Administrator of the Agency for International Development shall— (1) cooperate with appropriate international organizations, both governmental and nongovernmental; (2) look to the World Conservation Strategy as an overall guide for actions to conserve biological diversity;

(3) engage in dialogues and exchanges of information with recipient countries which stress the importance of conserving biological diversity for the long-term economic benefit of those countries and which identify and focus on policies of those countries which directly or indirectly contribute to loss of biological diversity;

(4) support training and education efforts which improve the capacity of recipient countries to prevent loss of biological diversity;

(5) whenever possible, enter into long-term agreements in which the recipient country agrees to protect ecosystems or other wildlife habitats recommended for protection by relevant governmental or nongovernmental organizations or as a result of activities undertaken pursuant to paragraph (6), and the United States agrees to provide, subject to obtaining the necessary appropriations, additional assistance necessary for the establishment and maintenance of such protected areas;

(6) support, as necessary and in cooperation with the appropriate governmental and nongovernmental organizations, efforts to identify and survey ecosystems in recipient countries worthy of protection;

(7) cooperate with and support the relevant efforts of other agencies of the United States Government, including the United States Fish and Wildlife Service, the National Park Service, the Forest Service, and the Peace Corps;

(8) review the Agency's environmental regulations and revise them as necessary to ensure that ongoing and proposed actions by the Agency do not inadvertently endanger wildlife species or their critical habitats, harm protected areas, or have other ad-verse impacts on biological diversity (and shall report to the Congress within a year after the date of enactment of this paragraph on the actions taken pursuant to this paragraph);

(9) ensure that environmental profiles sponsored by the Agency include information needed for conservation of biological diversity; and

(10) deny any direct or indirect assistance under this chapter for actions which significantly degrade national parks or similar protected areas or introduce exotic plants or animals into such areas.

(h) [102] ANNUAL REPORTS.—Each annual report required by section 634(a) of this Act shall include, in a separate volume, a report on the implementation of this section.

Footnotes:

A previous sec. 117, relating to infant nutrition, was repealed in 1978.

[95] 22 U.S.C. 2151p. Sec. 117 was redesignated from being sec. 118 by sec. 301(1) of Public Law 99–529, resulting in the creation of two sections 117. Sec. 301(2) of Public Law 99–529 (100 Stat. 3014) further deleted subsec. (d) of that section, which dealt with tropical forests, and then sec. 301(3) of Public Law 99–529 added a new section 118 entitled "Tropical Forests". This section, as added by sec. 113 of Public Law 95–88 (91 Stat. 537) and amended by sec. 110 of Public Law 95–424 (92 Stat. 948) and sec. 122 of Public Law 96–53 (93 Stat. 948), was further amended and restated by sec. 307 of the International Security and Development Cooperation Act of 1981 (Public Law 97–113; 95 Stat. 1533). This section previously read as follows:

"Sec. 118. Environment and Natural Resources.—(a) The President is authorized to furnish assistance under this part for developing and strengthening the capacity of less developed countries to protect and manage their environment and natural resources. Special efforts shall be made to maintain and where possible restore the land, vegetation, water, wildlife and other re-sources upon which depend economic growth and human well-being especially that of the poor.

"(b) In carrying out programs under this chapter, the President shall take into consideration the environmental consequence of development actions.". See also sec. 517(e) of the Foreign Operations, Export Financing, and Related Programs Appropriations Act, 2003 (division E of Public Law 108–7; 117 Stat. 185), relating to assistance to the new independent states of the former Soviet Union.

See also sec. 534 of the Foreign Operations, Export Financing, and Related Programs Appropriations Act, 1990 (Public Law 101–167; 103 Stat. 1228), as amended, relating to "Global Warming Initiative".

See also sec. 533 of the Foreign Operations, Export Financing, and Related Programs Appropriations Act, 1991 (Public Law 101–513; 104 Stat. 2013), as amended, relating to "Environment and Global Warming". See also sec. 532 of the Foreign Operations, Export Financing, and Related Programs Appropriations Act, 1993 (Public Law 102–391; 106 Stat. 1666), relating to "Environment".

[96] Sec. 562 of the Foreign Operations, Export Financing, and Related Programs Appropriations Act, 1991 (Public Law 101–513; 104 Stat. 2026), added a new chapter 10 to part I of this Act, providing for long-term development in sub-Saharan Africa, and made a conforming amendment by inserting "and chapter 10 of this part" here.

[97] 22 U.S.C. 2151p–1. Sec. 118 was added by sec. 301(3) of Public Law 99–529 (100 Stat. 3014). See also footnote 95.

[98] Sec. 209(e)(3) of the Admiral James W. Nance and Meg Donovan Foreign Relations Authorization Act, Fiscal Years 2000 and 2001 (H.R. 3427, enacted by reference in sec. 1000(a)(7) of Public Law 106–113; 113 Stat. 1536), stated that sec. 3003(a)(1) of Public Law 104–66 (109 Stat. 734) is not applicable to this subsection. Sec. 3003(a)(1) of that Act, as amended, provided that "* * * each provision of law requiring the submittal to Congress (or any committee of the Congress) of any annual, semiannual, or other regular periodic report specified on the list * * * [prepared by the Clerk of the House of Representatives for the first session of the One Hundred Third Congress] shall cease to be effective, with respect to that requirement, May 15, 2000.".

[99] Sec. 119, as added by Public Law 95–88 (91 Stat. 528), amended by sec. 111 of the Inter-national Development and Food Assistance Act of 1978 (92 Stat. 948), and by sec. 107 of the International Development Cooperation Act of 1979 (93 Stat. 362), was repealed by sec. 304(g) of the International Security and Development Cooperation Act of 1980 (Public Law 96–533; 94 Stat. 3147). See sec. 106 of this Act for text concerning energy technologies.

[100] 22 U.S.C. 2151q. Sec. 119, pars. (a) and (b) were added by sec. 702 of the International Environment Protection Act of 1983 (title VII of the Department of State Authorization Act, Fiscal Years 1984 and 1985, Public Law 98–164; 97 Stat. 1045).

[101] Section 533(d)(4)(A) of the Foreign Operations, Export Financing, and Related Programs Appropriations Act, 1990 (Public Law 101–167; 103 Stat. 1227), added "notwithstanding section 660" at this point.

[102] Pars. (c) through (h) were added by sec. 302 of Public Law 99–529 (100 Stat. 3017).

ANNEX II. ASSESSMENT TEAM BIOGRAPHIES

James (Jim) Tolisano, Biodiversity Conservation Specialist and Team Leader

Jim Tolisano has more than 30 years of professional experience in the design and implementation of biodiversity and forest conservation projects. He has held a wide variety of professional positions that integrate applied work in biodiversity conservation project planning, management and evaluation; tropical forest management; field biology; ecological monitoring; conservation communications; and environmental education. He has completed more than 50 consulting assignments in 35 countries in association with USAID, the World Bank, the United Nations Food and Agriculture Organization, Inter-American Development Bank, and many international, national, local, and tribal organizations. His work focuses on integrating economic and business development measures into biodiversity conservation practice. Jim serves as the Director of Kinship Conservation Fellows, a one-month fellowship program of the Kinship Foundation designed to strengthen conservation leadership through enhanced use of business, planning and management tools (www.kinshipfellows.org).

Jim formerly served as an Associate Professor of Conservation Science at the College of Santa Fe, New Mexico where he helped to create an innovative undergraduate conservation science degree program, and directed an outreach and education program for teachers and educators. He has published widely in both technical and creative periodicals and books, and has lectured at many universities. He completed undergraduate studies in social and environmental sciences at the University of Wisconsin-Madison, earned his Master of Science in forest ecology and watershed sciences at the University of Arizona and conducted doctoral research in parks, conservation science, and environmental education at the University of New Mexico.

Maria Mercedes Lopez-Silva, Biodiversity Conservation Specialist

Ms. Lopez-Silva has more than 15 years of professional experience designing and implementing environmental education programs targeted to communities that are reliant on a productive natural resource base for their livelihoods. She has worked as a field biologist assessing population changes in Costa Rican sea turtles. She has also served as the Director of the Wildlife Department for the Guatemalan National Council for Protected Areas, where she supervised flora and fauna research, collection, and trade, and developed conservation strategies of endangered species. Ms. Lopez-Silva has also supervised technical studies to re-design the Lago de Guija protected area and the Volcan de Agua protected area. She has developed sustainable development alternatives for five communities in the Sipacate-Naranjo National Park, and evaluated the ecological integrity evaluation of five protected areas. She holds an undergraduate degree in Biology from the University of San Carlos in Guatemala, and a Master's of Science in Sustainable Development and Conservation Biology from the University of Maryland in the United States.

ANNEX III. STATEMENT OF WORK (SOW)

GUATEMALA TROPICAL FORESTRY AND BIODIVERSITY (FAA 118 AND 119) ANALYSES

I. Task assignment

To conduct an assessment of tropical forests and biodiversity conservation needs for the purposes of complying with sections 118 and 119 of the Foreign Assistance Act of 1961, as amended, and country strategy guidelines under ADS 201.3.9.2, ADS 201.3.11.2.b, and ADS 204.4.1.

II. Proposed Candidates

James Tolisano, International Resources Group (IRG) Consultant

María Mercedes López -Silva, IRG Consultant

III. Objectives

To support the USAID/Guatemala Mission in assessing the biodiversity, tropical forestry, natural resource management, and other related environmental issues and identify contributions and/or potential contributions to meeting identified conservation needs by the Mission's proposed strategy.

IV. Background

The USAID/Guatemala bilateral strategy originally covering the period FY2003-2008 as modified by Operational Plans is being used by the Mission; however, a new draft underlying strategic approach has recently been developed that covers the period FY 2009 through FY 2014. USAID/Guatemala is required to carry out an assessment to ensure that its new plan is in concordance with the conservation of the country's biological diversity and forest resources. This assessment is mandated by the U. S. Foreign Assistance Act of 1961 Sections 118 and 119 which requires USAID to analyze national needs for conserving biological diversity and potential USAID contributions to these needs in all country strategy plans. Specifically, FAA Section 118 (e) and 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, the actions necessary in that country to achieve 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. (FAA, Sections 118 (e) and 119(d)."

This assessment will synthesize other information available on the biological and forest resources in Guatemala and the current status of these resources and the recognized pressures impacting them. It will include the actions and potential actions of the overall Mission program. Particular attention should be paid to developmental plans, particularly large scale plans in other sectors in which the Mission works. The goal should be not to provide lists of species, but to approach the assessment as a way to help prioritize eco-regions and watersheds, to determine common conservation challenges affecting them, and to begin to identify whether other sectors of the Mission program have roles to play in addressing

these issues. Attention should also be given to the quality of the existing data, and any critical gaps should be noted.

V. Scope of work and activities

Under the direction of a team leader, the assessment team shall evaluate biodiversity and tropical forest concerns in Guatemala. The study is conceptualized in two parts. The first part will result in a written report that follows relevant USAID guidance on Section 118-119 analysis, which is in the September 2005 Lessons Learned report:

(http://www.usaid.gov/locations/latin_america_caribbean/environment/118_119.html).

The second part will involve assistance in drafting an analysis of how and to what extent actions proposed in the country strategic plans meet, or could meet, the tropical forest and biodiversity needs thus identified. The assessment team will need to review the Guatemala Biodiversity and Tropical Forest Assessment (September, 2002, Modified December, 2003) an important reference document to help guide them in developing the new one.

The assessment team shall perform the following activities:

A) Data Collection. The background assessment will in general follow the illustrative outline presented in the attachment, and will synthesize existing data and information on the status of biodiversity and tropical forests in Guatemala. It will provide an overall description of Guatemala's biodiversity and tropical forestry assets, evaluate their current status, and identify the pressures and threats affecting those resources. Specifically, the team will:

1. Meet with USAID/Guatemala to get an understanding of the Mission's program goals and objectives under its proposed strategy. The Mission will 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 (e.g., the potential for raising expectations, and the need to be clear as to the purpose of the assessment) and respect Mission guidance. The team will discuss organizations to be contacted and any planned site visits with the Mission and coordinate as required.

2. The Mission Environment Officer (MEO) will facilitate meetings with other SO Teams at USAID to allow the team to gain a full understanding of the country program and strategy. The MEO will facilitate an exit briefing with USAID Mission Director.

3. Obtain, review, synthesize and analyze existing data and documentation on biodiversity conservation and tropical forest conservation in Guatemala, such as that prepared by government agencies for all sectors considered under the developing Mission Strategy, bilateral and multilateral donors (e.g., GEF, World Bank, FAO, UN, IADB, NADB, CABEL, The Netherlands), and national and international major NGOs active in the country (e.g., Rainforest Alliance, The Nature Conservancy, WWF, CI, etc). This documentation may include the National Biodiversity Conservation Strategies and Action Plan (NBSAP) and the Tropical Forest Conservation Act (TFCA).

4. Hold meetings with selected relevant ministries and agencies, donor organizations, NGOs, and other organizations which are involved in forest and biodiversity conservation or cross-cutting issues, and gather relevant information. Also the assessment team will hold a workshop with local and international NGOs chosen by the Technical Coordinators and USAID to discuss and obtain feedback on the assessment findings.

5. Conduct one to three priority site visits, only 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 Guatemala, with particular interest in analyzing information from other sector programs that impact tropical forest and biodiversity options and outcomes. The assessment will compile, summarize and analyze available information on the following themes:

1. The **Policy, Regulatory and Institutional Framework** for biodiversity and tropical forest resources including: a review of the policy and legislative basis for the protection of biodiversity and tropical forest resources, with attention to decentralization; Guatemala's participation in international treaties and agreements related to conservation; a description and overview of the Government institutions involved in the sector or whose programs directly impact this sector (e.g., Ministry of Agriculture, Ministry of Tourism, Ministry of Environment, etc.); and an overview of current national level plans to address policy issues related to biodiversity and tropical forest resource conservation (e.g. PINFOR, PINPEP forestry incentives, etc.).

2. An overview of the **Non-Governmental Organization** (NGO) community involved in biodiversity and tropical forest management activities including a list of the major organizations, the highlights of their program priorities and an approximate level of finance of their programs.

3. A description of the biodiversity and tropical forest conservation activities and commitments as well as descriptions of other major efforts that will impact these resources by other **Donors and Multilateral Organizations** operating in Guatemala, the highlights of their program priorities and an approximate level of finance for their programs. Particular emphasis shall be placed on plans for environmental impact assessments pursuant to planned large-scale infrastructure investments. If Guatemala has operational partnerships with **other U.S. Government Agencies** related to the environment sector, this section will also list and briefly describe those programs related to or impacting biodiversity and tropical forests (e.g. Tropical Conservation Forest Act-TFCA, U.S. Department of Interior-USDOI).

4. Provide a description of the major biodiversity and tropical forest conservation activities of the **Commercial Private Sector** to help identify ways to better foster private sector alliances. Of interest are the norms and standards followed by those commercial entities most engaged in management and use of Guatemala's tropical forests and tracts near protected areas, including, inter alia, major logging companies, tourism developers, and other land development concerns.

5. Provide a description of the **Status and Management of Protected Area System** in Guatemala (SIGAP) including an inventory of all declared and proposed areas (national parks, wildlife reserves and refuges, forest reserves, private reserves, sanctuaries, hunting preserves and other protected areas), including marine and coastal areas. The inventory will identify the institution(s) responsible for the protection and management of each area, its date of establishment, area, and, as much as possible, list the status of each. This section will also include an assessment of the current effectiveness of protection and management and major challenges facing these areas and their importance to the economy of the country (including productive assets, environmental services and recreation and tourism opportunities).

6. An assessment of the **Status and Protection of Endangered Species** in Guatemala, including in its territorial waters. This section should identify particularly important habitat conservation areas and issues and evaluate the pressures on those areas and efforts to mitigate pressures, including the participation and compliance with CITES.

7. An assessment of the **Status of Conservation outside the Protected Area System**, focused on the different natural resources ecosystems common to Guatemala, including forest resources,

rangeland resources, arid/semi-arid resources, coastal/marine ecosystems, wetlands and the sustainability of the agricultural landscape. This section will include a general discussion of the economic, ecological and social importance of each of these ecosystems, with particular attention to critical environmental services they provide (watershed protection, erosion control, soil and water conservation and amenity and recreation). Emphasis will be placed on the status of wetlands and desert/arid lands in Guatemala and any threats affecting them. It will also assess the relationship between current land tenure arrangements and effective conservation in the country.

8. An overview and assessment of the **Impacts of Major Development Projects and Plans** on biodiversity and tropical forest conservation, including an analysis of the current policy and regulatory framework for environmental review and permitting of their projects and plans.

9. An overall assessment of Guatemala programs for **Ex-Situ Conservation and Conservation of Economically Important Species and Germplasm** including as feasible, a list of the programs of natural history museums, zoos, herbariums, botanical gardens and captive breeding programs and provide a summary of existing conservation databases. It will also provide a description of on-going programs in Guatemala for the conservation of important species and germplasm including gene banks and other efforts to support the sustained production and protection of commercially important wild plant and animal species.

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 Guatemala in the current context, based on analysis of country donor and NGO responses to meet these needs. Prepare a report on the status of tropical forest and biodiversity conservation efforts in Guatemala and implications for USAID or other donor programming and environmental monitoring which shall define the actions necessary for conservation.

C) Report:

On the basis of the assessment activities specified above, the team will prepare a summary **Guatemala Tropical Forest and Biodiversity Analyses**. This assessment will follow the attached Agency guidance and include an analysis of the needs for building national capacity, both public and private, and an aware and informed public constituency for biodiversity and tropical forest conservation. It will identify particular issues affecting the protected area system and natural resources protection and management in general. The Consultant(s) will include recommendations regarding USAID's future role in conservation in Guatemala and where U.S. comparative advantages and capabilities are likely to have the greatest impact. As possible, these issues and recommendations should be prioritized to identify those requiring the most immediate attention.

The report, of approximately 30 to 45 pages in length (excluding appendices), shall include sections covering the following topics:

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

Table of Contents

Executive Summary

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 overview of the social, economic, and political context for sustainable natural resources management and the conservation of biodiversity and forests in Guatemala, 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.

C. 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.

D. An overview of the status of biodiversity in Guatemala, including terrestrial and aquatic (i.e. coastal/marine) ecosystem (or ecoregion) diversity, species diversity, threatened & endangered species, genetic diversity, agricultural biodiversity, ecological processes and ecosystem services, and values and economics of biodiversity and forests. A map of potential natural vegetation and of land use or land/forest cover should be provided if available.

E. An assessment of the threats to biodiversity, including direct threats and indirect threats or root causes of the direct threats (using the attached form).

F. A list or description of the actions necessary to conserve biodiversity and forests in Guatemala, 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/Guatemala strategy and program, including all SOs and SPOs, 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 (for all proposed SOs and SPOs) 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, and other background or supporting material as needed.

VI. Time required

The LOE for this assignment is a total of 65 person-days, to be allocated approximately as follows:

- Team Leader (James Tolisano) 35 days
- Local Technical Assistance (María Mercedes López Selva) 30 days

VII. Period of performance

September 13th to November 15th, 2009

VIII. Technical Coordinator

The technical coordinators will be IRG, Carey Yeager and Carmen María López, TCAP´s Environmental Specialist.

IX. Expected Outputs

- **Work Plan and Schedule:** The Consultant shall provide USAID with a Work Plan and Schedule within 5 days of contract inception. The Work Plan and Schedule shall be 3-5 pages long, and shall include a week-by-week listing of major activities by location (US, Guatemala City, ecoregions and coastal areas, other), including any planned site visits, and shall highlight planned interaction with USAID on no less than a weekly basis. The Work Plan and Schedule shall also include a preliminary report outline.

- **Draft Report:** The Consultant shall submit a Draft Report at the middle of the third week of the contract. The Draft Report shall follow the generic outline provided in the attachment to this SOW, as refined during the course of the contract in consultation with USAID. The Report shall not exceed forty-five pages, in English, with suitable annexes and pertinent figures (maps, institutional charts, tables) and references. Among the expected appendices is 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.

- **Final Analysis Report** for USAID/Guatemala that examines the biodiversity, tropical forestry, natural resource management, and other related environmental issues and identifies contributions and/or potential contributions to meeting identified conservation needs by the Mission's proposed strategy. USAID will provide its comments on the Draft Report within fifteen [15] working days of receipt of the Draft. The Consultant will then have 10 days to incorporate the comments and submit the Final Report. The Consultant 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.

X. Schedule and Logistics

Meetings in Guatemala will take place between September 13th and October 15th. The Consultant's team shall report to the USAID/Guatemala Mission Environment Officer or his/her designee. The team will coordinate logistical arrangements with Abt Associates and IRG, and 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/Guatemala Team. USAID/Guatemala will provide a letter of introduction to the Government of Guatemalan Agencies and other institutions being called upon to collaborate in providing information for this study. Abt Associates and IRG in Guatemala will assist the team by providing key references and contacts with USAID/Guatemala's Program Office and will also help facilitate meetings with other Mission SO Team Leaders or their staff to fully brief the team on USAID's program and future vision for their strategy.

ANNEX IV. LIST OF PERSONS / INSTITUTIONS CONTACTED

Individual	Institution
Ronaldo Mejía	Counterpart International
Ana Korina Castellanos Soza	Counterpart International
Mario Del Cid	Counterpart International
Gustavo Pinel	Rainforest Alliance
Claudio Cabrera	Rainforest Alliance
Gustavo Pinelo Morales	Rainforest Alliance
Carlos Morales	World Wildlife Fund
Teresa Robles	USAID
Michael Lofstrom	USAID
Mario Eddy Díaz Visquerra	Registro de Información Catastral (RIC)
Ogden Rodas	INAB
Edwin Oliva	INAB
Josué Ivan Morales Dardón	INAB
Adelso Revolorio Quevedo	INAB
Juan Carlos Godoy	The Nature Conservancy
Juventino Gálvez Ruano	Universidad Rafael Landívar
Fernando Miyares Siekavizza	Global Environment Facility/GoG
Manfredo Corado Esquivel	Global Environment Facility/GoG
Prudencio Rodríguez Menéndez	Global Environment Facility/GoG
Mario Jolon	PROBIOMA
Victor Hugo Ramos	Wildlife Conservation Society
Byron Castellanos	BALAM
Claudia Mariela López Díaz	CONAP
Edin López Tejada	CONAP
Javier Marquez	Defensores de la Naturaleza
Enma Leticia Diaz Lara	Ministerio de Ambiente y Recursos Naturales

ANNEX V. LIST OF PARTICIPANTS IN STAKEHOLDER WORKSHOP

Abt Associates Inc.

Proyecto: RAISE-PLUS/GUATEMALA – USAID

IRG an company

Evento: **Informe Estado de la Biodiversidad y Bosques Tropicales de Guatemala (118/119)**
Lugar: Hotel Radisson, Guatemala
Fecha: 04-nov-09

No.	Nombre del Participante	Organización	Dirección y Teléfono	Email	Firma
1	Claudia García	ARNPG		info@reservasdeguatemala.org	
2	Richard Warner / Director Prog. USAID Conservación Cuencas CA	Chemonics		rwarner@chemonics.com	
3	Carlos Rodríguez / Director designó a Ingrid Arias o Miriam Castillo	CI		crodriguez@conservation.org	
4	Corina Castellanos	CI Peten		kcastellanos@counterpart.org	
5	Claudia Santizo / Secretaria Grnl	CONAP		csantizo@conap.gob.gt	
6	Selvin Pérez / Coordinador OTECBIO	CONAP	Edif. IPM 6to nivel of. Otecbio 4150 5408	otecbio@conap.gob.gt	
7	Mercedes Barrios / Vida Silvestre	CONAP		mbarrios@conap.gob.gt	
8	Fernando Castro / Areas Protgegidas	CONAP	Tel 24227700 ext 1030	fercastro@conap.gob.gt	
9	Mariela López / Directora Regional	CONAP Peten	41506581	Marielalopezdiaz@hotmail.com	
10	Rony Mejía / Mario del Cid	Counterpart International	tel: 23691347	rmejia@counterpart.org	

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Proyecto: **RAISE-PLUS/GUATEMALA – USAID**

Evento: **Informe Estado de la Biodiversidad y Bosques Tropicales de Guatemala (118/119)**
Lugar: Hotel Radisson, Guatemala Fecha: 04-nov-09

11	Yvonnne Ramírez / Directora Ejecutiva	**FCG-FCA**	17 Avenida D 0-19 Zona 15 Col El Maestro	yramirez@fcg.org.gt	
12	Luis Castillo / Director	**FDN**	2a Av. 14-08 zona 14	lcastillo@defensores.org.gt	
13	Oscar Núñez	**FDN**	2a Av. 14-08 zona 14	onunez@defensores.org.gt	
14	Marco Tulio Diaz/ Gerente designó a Ana Luisa Gálvez	**FONACON**	23314773	fonacon@intelnet.net.gt	
15	Roberto Bosch	**GREMIAL FORESTAL**	Cámara de Industria	rforest@lignum.com.gt	
16	Juventino Galvez / Director	**IARNA-URL**	Universidad Landivar zona 15, Vista Hermosa III	jugalvez@url.edu.gt	
17	Alejandra Sobenes	**IDEADS**		asobenes@gmail.com	
18	Edmundo Vásquez	**IDEADS**		vasquezmundo@yahoo.com	
19	Josué Morales / Gerente Designió a Adelsio Revolorio	**INAB**		jmorales@inab.gob.gt gerencia@inab.gob.gt	
20	Ogden Rodas	**INAB**		ogden.rodas@segeplan.gob.gt orodasc@yahoo.com	

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Proyecto: **RAISE-PLUS/GUATEMALA – USAID**

Evento: **Informe Estado de la Biodiversidad y Bosques Tropicales de Guatemala (118/119)**
Lugar: Hotel Radisson, Guatemala Fecha: 04-nov-09

21	María José González	**MARFUND**	0 Calle 19-45 "A", Z 15 VH II	mjgonzalez@turbonett.com	
22	Emma Díaz / Viceministra	**MARN**	20 calle 28-58 zona 10 Tel: 2423-0500		
23		**MARN**	20 calle 28-58 zona 10 Tel: 2423-0500		
24		**MARN**	20 calle 28-58 zona 10 Tel: 2423-0500		
25		**MARN**	20 calle 28-58 zona 10 Tel: 2423-0500		
26	Jenny Vásquez	**MARN**	20 calle 28-58 zona 10 Tel: 2423-0500	jecm18@yahoo.com	
27	Eureka Lucero	**MARN**	20 calle 28-58 zona 10 Tel: 2423-0500	lucerodelacruz1@gmail.com	
28	~~Carlos Mansilla~~ / Cambio Climático	**MARN**	20 calle 28-58 zona 10 Tel: 2423-0500	cclimatico@marn.gob.gt	
29	Prudencio Rodríguez	**PDR**		prudencior@gmail.com	
30	Manfredo Corado	**PDR**		mrcorado@gmail.com	

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Abt Associates Inc.

Proyecto: RAISE-PLUS/GUATEMALA – USAID

IRG an ID company

Evento: **Informe Estado de la Biodiversidad y Bosques Tropicales de Guatemala (118/119)**
Lugar: Hotel Radisson, Guatemala Fecha: 04-nov-09

31	Claudio Cabrera	**Rainforest Alliance**	José R. Carrera.	ccabrera@ra.org	
32	Román Carrera	**Rainforest Alliance**		jcarrera@ra.org	
33	Omar Samayoa	**Rainforest Alliance**		osamayoa@ra.org	
34	Gustavo Pinelo	**Rainforest Alliance Peten**		gpinelo@ra.org	
35	J. Trujillo	**Rainforest Alliance Peten**		jtrujillo@ra.org	
36	Eddy Diaz	**Registro de Información Catastral**		ediaz@catastro.gob.gt - ediazvisquerra@yahoo.com	
37	Juan Carlos Godoy / Director	**TNC**	12 Av. 14-41 zona 10 Oakland Tel: 2367-0480	jcgodoy@tnc.org	
38	Jorge Cardona / Director de Proyectos	**TNC**		jcardona@tnc.org	
39	Ana Vilma Pocasangre	**USAID**	Km. 6.5 Final Boulevard Los Próceres, Tel: 2422-4000	apocasangre@usaid.gov	
40	Teresa Robles	**USAID**	Km. 6.5 Final Boulevard Los Próceres, Tel: 2422-4000	trobles@usaid.gov	

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Proyecto: **RAISE-PLUS/GUATEMALA – USAID**

Evento: **Informe Estado de la Biodiversidad y Bosques Tropicales de Guatemala (118/119)**
Lugar: Hotel Radisson, Guatemala Fecha: 04-nov-09

41	Víctor Hugo Ramos	WCS		vhramos@wcs.org	
42	Roan McNab	WCS		wcspeten@secmas.guate.net	
43	Carlos Morales designó a Carlos Ruiz	WWF		cmorales@wwfca.org	
44	Jim Tolisano / Consultor	IRG		jtolisano@gmail.com	
45	Ma.Mercedes Lopez-Selva / Consultora	IRG		mmlsq@yahoo.com	
46	Janet Esquivel	IRG		Janet.esquivel@gmail.com	
47	Camen Ma. López	ABT	14 Calle 3-50 Z.10 Ed. Nuevo Center	Carmen_Lopez@Abtassoc.com	
48	Luúa Corral	CEA-UVG	11 calle 15-79 Zona 15 Vista Hermosa III	lucia.corral@gmail.com lcorral@uvg.edu.gt	
49	Edin López	CONAP-Peté		edinlopez@yahoo.es	
50					

Asistentes 31

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ANNEX VI. ANTHROPOGENIC THREATS TO BIODIVERSITY AND FORESTS IN GUATEMALA- A PRIORITIZATION OF THE INTENSITY AND DURATION OF THREATS AND THE FEASIBILITY OF INTERVENTION.

The following table summarizes a qualitative assessment of the principle threats from human activities to biological diversity and tropical forests in Guatemala. The assessment is based on a methodology developed by Carey Yeager of Abt Associates, and has been adapted to predict the intensity and duration of threats and prioritize the feasibility of interventions to mitigate or reduce threats. The assessment incorporates the following factors, and the cumulative analysis relies on the following key letters and numbers:

1. **Intensity of impacts:**

(i) Impact intensity	N = no impact M = medium impact L = low impact S = severe impact
(ii) Impacts will primary affect:	E = ecosystem scale impacts I = impacts primarily affecting individual species
(iii) Area estimated to be affected by impacts:	1= 0 ha to 999 ha 2 = 1,000 ha to 9,999 ha 3 = 10,000 ha to 99,999 ha 4 = 100,000 ha to 999,999 ha 5 = 1,000,000 to 9,999,999 ha 6 = >10,000,000 ha

2. The impacts from threats are estimated to be either **Direct (D)** or **Indirect (I)**.
3. **Timeframe** – the amount of time it will take for impacts to become evident; and the length of time they are likely to endure.

(i) *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

(ii) *Impact duration*: T = impacts are temporary, once threat is removed
E = impacts are enduring, and will continue after threat is removed

4. **Feasibility of intervention by USAID**

   F = Feasible, with sufficient human/financial resources available to effectively respond to the threat and well documented intervention models available from previous projects in similar contexts.

   U = Unknown, human/financial resources possibly available, and proven interventions models uncertain.

   N = Not feasible, resources required are greater than available, and no proven intervention models available.

5. **Cumulative Risk Assessment –** Each of the above factors was combined to produce a weighted average score predicting how severe the risk to biodiversity and tropical forests could be from each threat. Risk assessments are based on a scale of 1-5, with 1 representing minimal risk and 5 representing extreme risk. Scores of 1-2 on this scale suggest reduced threats that are less severe and where interventions can perhaps produce rapid and certain benefits. Scores of 3-4 on this scale suggest severe threats where interventions are required immediately and for extended time periods. Scores of 5 on this scale suggest the most severe threats where a significant regional or global response will be required for extended time periods.

Risk Assessment	Intensity	Timeframe	Feasibility of Intervention
1	Intensity: N or L Affected Area: 2 or less	Onset: M or L Duration: T	F
2	Intensity: L or M Affected Area: 2-4	Onset: M Duration: T	F
3	Intensity: M Affected Area: 3-5	Onset: M or S Duration: E	F
4	Intensity: S Affected Area: >4	Onset: S or I Duration: E	F or U
5	Intensity: S Affected Area: 6	Onset: I Duration: E	U or N

The results from the assessment are summarized in Table A.1 below.

Table A.1. A Qualitative Assessment of Anthropogenic Threats to Biodiversity and Tropical Forests in Guatemala

Type of Threat	Predicted Impacts	Intensity of impacts	Threat Source	Time-frame	Feasibility	Rank
Habitat Loss, Degradation and Fragmentation – Deforestation/Land Conversion to Agriculture	Alters nutrient cycles; alters hydrological cycles; increases sedimentation; can introduce toxins into ecosystem; changes native vegetation composition and structure; may alter structure and decrease fertility of soil; may result in population declines or local extinctions for some species; significant increase in carbon emissions.	SE4	D and I	SE	F	4
Habitat Loss, Degradation and Fragmentation – Fire	Alters nutrient cycles; alters hydrological cycles; increases sedimentation[5]; may change forest composition and structure; may alter structure and decrease fertility of soil; may result in population declines or local extinctions for some species.	SE4	D	IT	F	3
Habitat Loss, Degradation and Fragmentation – Road construction	Interferes with wildlife dispersal and migration routes; can significantly increase forest product extractions, hunting pressures, wildlife trafficking, introduction of exotic plant and animal species, and land conversion to agriculture.	SE4	D and I	MT	F	3
Habitat Loss, Degradation and Fragmentation – Mineral and Petroleum Development	Introduces toxins into ecosystem; can alter micro-climates; can alter structure and decrease fertility of soil; can result in population declines or local extinctions for some species; can increase carbon emissions;	ME3	D and I	IT and ST	F	2
Habitat Loss, Degradation and Fragmentation – Exotic or invasive species	Can change native vegetation composition and structure; may alter structure and decrease fertility of soil; can result in population declines or local extinctions for some species; may degrade water chemistry and flow regimes by clogging waterways.	ME5	D and I	ME	F	3

[5] Increased sedimentation is due to erosion of topsoil. Consequences include reduced fertility and productivity on land and decreased aquatic/marine productivity.

Type of Threat	Predicted Impacts	Intensity of impacts	Threat Source	Time-frame	Feasibility	Rank
Habitat Loss, Degradation and Fragmentation – Drug trafficking	Reduces or eliminates management and policy enforcement; can introduce toxins into ecosystem; provides unregulated financial and material support for overexploitation of wildlife and forest products, and land conversion to agriculture.	ME4	I	MT	U	3
Over-exploitation – Forest products	Increases sedimentation; alters hydrologic cycles; can increase toxins into ecosystem; can change native vegetation composition and structure; alters micro-climate; may alter structure and decrease fertility of soil; may result in population declines or local extinctions for some species; increase in carbon emissions.	SE4	D and I	IE	F	3
Over-exploitation – Wildlife harvests for bushmeat	May result in population declines or local extinctions for some species.	MI	D	MT	F	3
Over-exploitation – Wildlife trafficking	May result in population declines or local extinctions for some species.	MI	D	MT	F	3
Over-exploitation – Marine resources	May result in population declines or local extinctions for some species; destructive fishing practices can degrade habitat structure and composition.	SE4	D and I	SE	F	4
Environmental Contamination and Degradation – Liquid, solid and atmospheric wastes	Introduces toxins into ecosystem; can alter micro-climates; can alter structure and decrease fertility of soil; can result in population declines or local extinctions for some species; can increase carbon emissions.	SE4	D and I	ME	F	3
Climate Change	May significantly alter hydrologic cycles, leading to unpredictable flooding and droughts; may change forest composition and structure; may alter structure and decrease fertility of soil; may result in population declines or local extinctions for some species; may result in significant migration of human populations.	SE6	D and I	LE	Adaptation F Mitigation U	5

U.S. Agency for International Development
1300 Pennsylvania Avenue, NW
Washington, DC 20523
Tel: (202) 712-0000
Fax: (202) 216-3524
www.usaid.gov