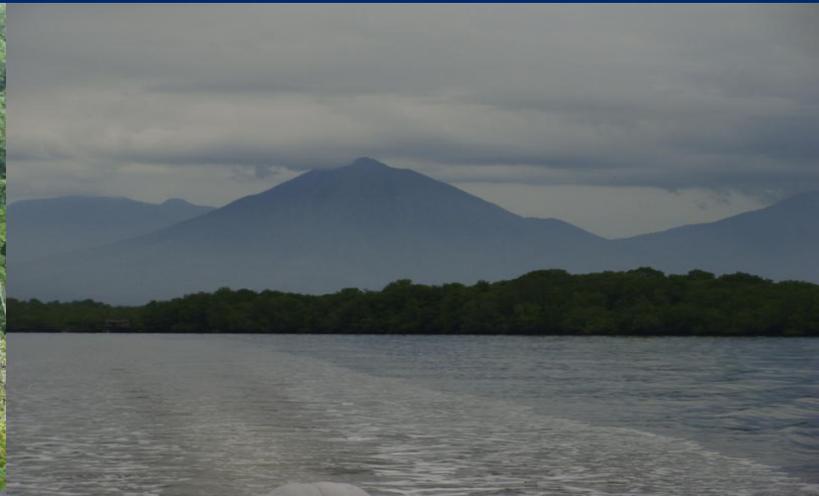




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# REPORT ON BIODIVERSITY AND TROPICAL FOREST IN EL SALVADOR



**MARCH 2010**

This publication was produced for the United States Agency for International Development by Bruce Kernan and Francisco Serrano.

## **COVER PHOTOGRAPHS**

Upper left: Forest in Montecristo National Park.

Lower left: Sea turtle release

Upper right: Chaparrastique Volcano seen from Jiquilisco Bay

Lower right: View of Coatepeque Lake in Santa Ana.

Credit: Bruce S. Kernan

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USAID/CTO: Mary Rodriguez.

# **Report on Biodiversity and Tropical Forests in El Salvador**

Bruce S. Kernan  
Francisco Serrano

San Salvador  
March 2010

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# ACRONYMS

ADESCO	Asociación de Desarrollo Comunal
AECI	Spanish Agency for International Cooperation
AGUA	Access, Management and Rational Use of Water Project
AMAR	Asociación Amigos del Árbol
ANDA	Administración Nacional de Acueductos y Alcantarillados
ANP	Área Natural Protegida
ARENA	Alianza Republicana Nacionalista
ASACMA	Asociación Salvadoreña para la Conservación del Medio Ambiente
BID	Inter-American Development Bank
BIOFOR	Biodiversity and Forestry Indefinite Quantity Contract
CAM	Central America and México
CATIE	Centro Agronómico Tropical de Investigación e Enseñanza
CAFTA/DR	Central American-Dominican Republic Free Trade Agreement
CCAD	Comisión Centroamericana de Ambiente y Desarrollo
CBD	Convention on Biodiversity
CEL	Comisión Ejecutiva Hidroeléctrica del Río Lempa
CENDEPESCA	Center for Development of Fishing
CENTA	Centro Nacional de Tecnología Agrícola y Forestal
CEPRODE	Centro de Protección Contra Desastres
CITES	Convention on International Trade in Endangered Species
CORSATUR	Corporación Salvadoreña de Turismo
CNR	National Center of Register
DANIDA	Danish International Development Agency
DGPN	General Directorate for Natural Patrimony
DGEA	General Directorate for Agricultural Studies
DGFWI	General Directorate for Forestry, Watersheds and Irrigation
EIS	Environmental Impact Study
FAA	Foreign Assistance Act
FAO	Food and Agriculture Organization of the United Nations
FIAES	Fondo para las Iniciativas de las Américas-El Salvador
FLMN	Farabundo Martí Front for National Liberation
FOMILENIO	Millennium Fund
FORGAES	Project to Strengthen Environmental Management in El Salvador
FONAES	Fondo Nacional Ambiental de El Salvador
FOPRAS	Environmental NGO Institutional Strengthening Project
FUNDAMUNI	Fundación de Apoyo a Municipios de El Salvador
FUNEDES	Fundación Empresarial para el Desarrollo en El Salvador
FUNZEL	Fundación Zoológica de El Salvador
FUSADES	Salvadoran Foundation for Socio-Economic Development
FUTECMA	Fundación Técnica Pro Medio Ambiente
FY	Fiscal Year
GDFWMI	General Directorate for Forests, Watershed Management and Irrigation
GEF	Global Environment Facility
GOES	Government of El Salvador
GTZ	German Agency for Technical Cooperation
IBA	Important Bird Areas
IEE	Initial Environmental Evaluation

IMCCW	Conservation of Critical Watersheds Project
ISREN	Salvadorian Institute of Natural Renewable Resources
ISTA	Salvadoran Institute for Agrarian Reform
IUCN	International Union for the Conservation of Nature
KAB	Key Areas for Biodiversity
MAB	Program on Man and the Biosphere
MAG	Ministry of Agriculture and Livestock
MARN	Ministry of Environment and Natural Resources
MCI	Municipal Competiveness Index
MITUR	Ministry of Tourism
MCC	Millenium Challenge Corporation
NGO	Non-Governmental Organization
PNODT	National Plan for Managing and Developing Territory
PTT	Program for Transferred Land
Ramsar	Convention on Wetlands of International Importance
RENAPES	Association of Proprietors of Private Natural Reserves of El Salvador
SANP	National System of Protected Areas
SNET	National Service for Territorial Studies
SO	Strategic Objective
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNDP	United Nations Development Program
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency

# EXECUTIVE SUMMARY

## **Purpose of the Report**

USAID/El Salvador is preparing a new country development strategy for the period from 2010 to 2014. Sections 118 and 119 of the Foreign Assistance Act require each USAID country development strategy to include an analysis of the actions necessary in that country to achieve conservation and sustainable management of biological diversity and tropical forests and of the extent to which the actions proposed for support by USAID meet these needs. This report provides USAID/El Salvador with this analysis and recommends a strategy it to assist El Salvador to protect its biodiversity and forests.

## **El Salvador's Biodiversity and Tropical Forests**

The most useful vegetation classification for El Salvador distinguishes eleven vegetative communities. Most of these communities have been modified and no longer occur over in much of their original range other than in small, remnant patches. By far the most extensive vegetative community was formerly the semi-humid deciduous forest, which occurred throughout El Salvador, although it has now largely been replaced by pasture, annual crops and coffee plantations. The semi-humid savannah was not as extensive, but it occurred within and around the semi-humid deciduous forest. In the Northern Mountain Region the oak-pine vegetation community still is common, and perhaps is expanding as secondary forest regenerates on abandoned pastures and fields. The other vegetative communities in El Salvador are the cloud forest, the mangrove forest, the chaparral, the morral forest, gallery forest and the beach and high savanna communities. El Salvador, unlike the other Central American countries, has no lowland humid tropical rainforest.

Less information is available on El Salvador's aquatic ecosystems than its terrestrial ecosystems. Obvious large sub-categories of aquatic ecosystems in, however, are the freshwater, estuarine and marine bodies of water. These could be further sub-divided by their chemical and physical characteristics. Almost all of El Salvador's fresh water bodies are heavily contaminated with industrial, domestic and agricultural wastes. Its estuaries are probably less contaminated than its rivers and lakes. Its marine waters are contaminated mostly near to the mouths of large rivers.

El Salvador retains a high level of species diversity. It has over 50,000 species of fungi, 1002 trees, 521 orchids, 759 fresh and marine fish, 709 butterflies, over 600 algae, 548 birds, 481 mollusks, 403 grasses, 294 lichens, 233 mosses, 252 ferns, 127 bromeliads, 191 crustaceans, 144 mammals, 127 annelids, 99 reptiles, and 32 amphibians. El Salvador has no endemic animal species but does have a few endemic plant species and a number of plant and animal species that are endemic only to northern Central America.

Relatively little is known about the genetic diversity within El Salvador's domestic and wild organisms, because it has hardly been studied. A few studies of the genetic diversity of animals, however, do indicate that reduced populations have little genetic diversity and tend to inbreed, which makes them more vulnerable as a species to diseases and to changes in habitat and climate.

El Salvador has 213 species of terrestrial or aquatic plants or animals whose survival as a species within El Salvador is considered threatened, and 181 whose survival within El Salvador is considered endangered. Most of these threatened and endangered species require primary forest habitat in order to successfully reproduce. Primary forest habitat now occurs on only about 21,000 hectares in El Salvador or only one percent of its total terrestrial area. About half of this primary forest lies within the boundaries of its eight largest protected natural areas.

Estimates of El Salvador's forest area vary from as low as 337,200 ha to as high as 1 million hectares. The differences in estimates probably are due to different definitions of what constitutes a forested area, different measurement techniques and different dates of measurement. The largest part of this forest area is young secondary forest, some of which has regenerated since the late 1980's as a result of the abandonment of agricultural land and pasture. By contrast, the area of primary forest, or forest that has not been drastically changed by human actions, is only about 21,000 hectares. El Salvador's forest area is economically very important not so much for its yield of products as for its role in reducing the risk from natural disasters and producing clean and abundant supplies of water.

### **Direct and Indirect Threats to El Salvador's Biodiversity and Forests**

The single greatest direct threat to El Salvador's terrestrial biodiversity is the small total area and small size of the areas that remain in El Salvador of primary forest habitat. Over-exploitation, introduced, aggressive fish species, and contamination are threats principally to El Salvador's fresh water ecosystems and species. A warming climate may become a threat to El Salvador's ecosystems and species, especially on the coast and at higher elevations.

The greatest current indirect threat to El Salvador's biodiversity is the uncertain legal status of the protected areas that were reserved under the 1982 land reform. Only 52 of 144 areas have been transferred legally to MARN. Until the remaining areas are legally titled they will be at risk from invasion by rural people and subsequent elimination or degradation of their natural vegetation. Also, all of the protected areas, legally declared or not, face a threat from rural people, sometimes supported by politicians who tend to consider them as empty, economically unimportant areas where their demands for access to land and natural resources can be met.

Pervasive conflict over access to land and natural resources is another severe indirect threat to El Salvador's biodiversity. Infrastructure projects, such as new and improved roads and hydroelectric projects represent a third indirect threat to Salvadorian biodiversity and primary and secondary forests. A fourth indirect threat concerns the expansion of the area of agriculture and pasture. While during the 1990's and early 2000's, there was a trend of increasing area of secondary forest if the incentives for Salvadorian agriculture and livestock were to become more positive, then the area of agriculture and pasture might expand again, at the expense of the new secondary forest.

### **Conclusions and Recommendations**

The report concludes that the actions USAID/El Salvador proposes to finance during the period 2010 to 2014 will be unlikely to cause adverse effects on El Salvador's biodiversity and tropical forests. USAID/El Salvador's environmental review process would, in any case, identify any potential adverse effects of proposed actions on El Salvador's biodiversity and tropical forests and bring them to the attention of decision makers. Effective measures could then be taken to avoid, mitigate or compensate for these adverse impacts.

El Salvador's biodiversity and forests make an enormous, although largely unquantifiable, contribution to the welfare of its citizens. Therefore, the conservation of El Salvador's

biodiversity and forests is necessary for El Salvador to become a prosperous, democratic country with healthy and educated citizens. USAID/El Salvador, therefore, during the period 2010 to 2014, should not just avoid actions that would cause adverse effects on El Salvador's biodiversity and forests. Rather, it should plan, design and finance four broad types of actions to assist El Salvador to conserve its biodiversity and forests.

First, USAID/El Salvador should coordinate systematically and intensely with other institutions when it conceives, designs, finances, implements and evaluates conservation actions. Such coordination will enable it to assist El Salvador to avoid duplication of conservation actions, reinforce conservation initiatives, stimulate the sharing of successful conservation experiences and create institutional momentum for achieving a common set of conservation objectives.

Second, USAID/El Salvador should strengthen El Salvador's capacity for environmental assessment, so that it can identify, evaluate, and avoid, mitigate or compensate when necessary potential negative effects of development activities on its biodiversity and forests. An effective environmental review process in El Salvador should complement and support its economic growth.

Third, USAID/El Salvador should assist El Salvador to conserve its biodiversity and forests by ensuring that the activities it finances are well-designed and effectively implemented. Projects should (a) build on the lessons that have been learned from prior conservation projects; (b) be designed and implemented according to high technical standards; (c) be aligned with and support El Salvador's conservation priorities; (d) establish and be monitored and evaluated according to specific conservation objectives; and (e) work through and strengthen Salvadorian institutions that are involved in conservation actions.

Fourth, USAID/El Salvador should finance some or all of the following priority conservation actions:

- 1) Conservation within Protected Areas: Protected areas conserve the natural habitat which a country's threatened and endangered species require in order to survive as a species within the country. This report recommends that USAID/El Salvador concentrate its financing under this category of conservation action on (a) providing the resources to ISTA and MARN to finalize the legal status of the 89 pending areas that should be transferred to MARN under the terms of the 1980 land reform and further transferring to the municipal governments those areas that are too small to remain under the administrative control of MARN; (b) assisting the General Direction for Natural Patrimony to establish the eight protect areas on a firm legal, technical, administrative and financial basis; (c) studying the possibilities for adding a large protected area in northeast El Salvador; (d) preparing technically sound management plans for the eight priority protected areas and (e) assisting ISTA to quickly and effectively transfer the remaining natural areas under its jurisdiction to the State. The total cost for these priority actions is estimated to be US\$1,665,000.
- 2) Conservation outside of Protected Areas: Outside of protected areas, El Salvador has delimited on maps other areas such as Conservation Areas, Important Bird Areas, and Biosphere Reserves. Also, El Salvador has large new areas of secondary forests whose silvical characteristics, location and potential economic importance have not been studied. The report recommends that USAID/El Salvador finance (a) an evaluation of the usefulness for conservation of these areas; (b) an evaluation of El Salvador's secondary forest and (c) an evaluation of prior conservation actions that have been

carried out outside of protected areas in El Salvador. The estimated cost of these priority conservation actions is US\$195,000.

- 3) Policies, Strategies, Laws and Regulations: The conservation of El Salvador's biodiversity and forests requires coherent conservation policies, strategies, laws and regulations. The report recommends that USAID/El Salvador support MARN in the preparation of the president's report to Salvadorians on the state of El Salvador's environment and support MAG in the formulation of policies for El Salvador's secondary forest, at an estimated cost of US\$135,000.
- 4) Conservation Research: El Salvador needs much more research in order to obtain the knowledge that forms the basis for protecting and managing its biodiversity and forests. USAID/El Salvador should (a) finance the design of a fund for research on biodiversity and forests at a cost of about US\$45,000; (b) finance the seed money for a research fund at a cost of US\$500,000; and (c) finance the collection of baseline data for monitoring the effects of climate change at a cost of US\$240,000.
- 5) Conservation Education: To conserve its forests and biodiversity, El Salvador requires adequate numbers of well-educated conservation scientists, professionals, technicians and workers, in a variety of professional fields. Few Salvadorians are studying the conservation fields, even outside of El Salvador. This report recommends that USAID/El Salvador finance a thorough study of El Salvador's education needs for conservation and finance educational scholarships in conservation fields. The estimated cost of these conservation actions is US\$1,295,000.
- 6) Institutional Capacity: El Salvador's ability to conserve its biodiversity and forests will largely depend on the capacity of its public and private conservation institutions. USAID/El Salvador should finance a study that clarifies the role of the different Salvadorian conservation institutions and a process that transfers responsibility for El Salvador's many small public protected areas to municipal governments. It should also finance actions to expand and solidify the role of private landowners in conservation. The estimated budget for these actions is US\$765,000.
- 7) Conflict Resolution and Land Use Planning: Conservation of El Salvador's biodiversity and tropical forests requires effective planning and regulation of the uses of the country's terrestrial and marine territory. A systematic process for resolving conflicts over land use should be incorporated into the existing land use planning and regulation process. This report recommends that USAID/El Salvador finance (a) training in conflict resolution processes and (b) support MARN in designing and implementing conflict resolution processes. The estimated cost of US\$140,000.
- 8) Public Support for Conservation: Salvadorian citizens must support conservation of El Salvador's biodiversity and forests if conservation programs are to be effective and long-term. This report recommends that USAID/El Salvador finance a public conservation education program that would last two years and cost approximately US\$375,000.
- 9) Financial Incentives for Conservation: There are many potential ways in which financial incentives for conservation could be increased in El Salvador. This report recommends that USAID/El Salvador finance an evaluation of one of these ways, the assignment of exclusive rights to utilize natural resources. The estimated cost is US\$45,000.

- 10) **Financing for Conservation:** Many possibilities exist for augmenting the funding available for conservation in El Salvador. This report recommends, however, that USAID/El Salvador finance the studies and actions required to establish a new fund within FIAES whose income would be dedicated to the management of El Salvador's eight priority protected areas and the private lands with primary forest that are adjacent to them. Designing and obtaining financing for such a fund would require about US\$560,000.

This report recommends a total estimated budget for financing the priority conservation actions over the period from 2010 to 2014 of US\$5,960,000. This is not a large investment compared to the enormous economic value of El Salvador's biodiversity and forests. The investments that this report recommends would enable El Salvador to resolve many of its priority conservation issues and at a critical juncture in its history of conservation efforts to establish the conditions for it to achieve the long-term conservation of its biodiversity and forests.

#### **Priority conservation actions by category with estimated required budget**

<b>Priority Conservation Action by Category</b>	<b>Estimated Budget</b>	<b>Type of Activity</b>
<b>Conservation within Protected Areas</b>	<b>1,665,000</b>	
Support ISTA & MARN to complete legalization of 89 areas	500,000	Program
Analyze enlargement of eight priority areas	480,000	Study
Study protected area for northeast	45,000	Study
Prepare management plans for 8 priority protected areas	640,000	Study
<b>Conservation outside of Protected Areas</b>	<b>195,000</b>	
Evaluate prior conservation projects	60,000	Study
Evaluate conservation designations	45,000	Study
Evaluate secondary forest	90,000	Study
<b>Policies, laws &amp; regulations</b>	<b>135,000</b>	
Support report on the State of El Salvador's Environment	45,000	Program
Formulate policies for secondary forest	90,000	Study
<b>Conservation Research</b>	<b>785,000</b>	
Design fund for field conservation research	45,000	Study
Provide financing for research fund	500,000	Fund
Collect baseline data for climate change	240,000	Study
<b>Conservation Education</b>	<b>1,295,000</b>	
Finance advanced conservation education in other countries	800,000	Training
Design curriculums for Salvadorian conservation education	45,000	Training
Train municipal and community leaders	450,000	Training
<b>Institutional capacity</b>	<b>765,000</b>	
Analyze institutional roles and responsibilities	45,000	Study
Transfer small protected areas to municipalities	500,000	Program
Support privately owned protected areas	220,000	Program
<b>Conflict resolution and land use planning</b>	<b>140,000</b>	
Train in conflict resolution techniques	40,000	Training
Fund for MARN conflict resolution & land use planning	100,000	Study
<b>Public support for conservation</b>	<b>375,000</b>	
Design communication program	15,000	Study
Implement communication program	360,000	Program
<b>Financial incentives</b>	<b>45,000</b>	
Evaluate exclusive rights	45,000	Study
<b>Financing for Conservation</b>	<b>560,000</b>	
Design a conservation fund	60,000	Study
Finance conservation fund	500,000	Fund
<b>TOTAL</b>	<b>5,960,000</b>	

# **I. INTRODUCTION**

## **A. PURPOSE OF THE REPORT**

USAID/EI Salvador is preparing a new country development strategy for the period from 2010 to 2014. Sections 118 and 119 of the Foreign Assistance Act require each USAID country development strategy to include an analysis of the actions necessary in that country to achieve conservation and sustainable management of biological diversity and tropical forests and of the extent to which the actions proposed for support by USAID meet these needs. This report provides USAID/EI Salvador with this analysis and recommends a strategy it to assist EI Salvador to protect its biodiversity and forests.

## **B. SCOPE OF WORK**

The Scope of Work for this report states the following six tasks (Appendix B):

- Compile information related to, and describe the tropical forests and biological diversity of EI Salvador, including their current status and trends;
- Describe the factors affecting the management of these natural resources, including the principal threats and impediments to conservation and sustainable management of tropical forests and biodiversity in EI Salvador;
- Review the current institutional infrastructure for the management of tropical forests and biodiversity, including a description of major organizations, both public and private, which have a role in this process. Interview key personnel of key institutions;
- Review the legislative basis, both national and local, for the protection of biological resources, including tropical forests, in EI Salvador (including the ratification of and compliance to international treaties and agreements such as CITES, Convention on Biological Diversity, Inter American Convention for the Protection and Conservation of Sea Turtles, Ramsar, and the effectiveness of national implementation);
- Identify the full range of cost effective and implementable actions (including priorities) necessary to achieve sustainable management of tropical forests and biological diversity in EI Salvador, and;
- Identify the extent to which the actions proposed for support by USAID/EI Salvador meet the needs thus identified, and recommend any further actions not described or outlined in the concept papers. Analyze the effects of USAID/EI Salvador's entire proposed strategy (FY 2010 – FY 2014) on EI Salvador's tropical forests and biodiversity, in particular the proposed strategic objectives of Democracy and Governance, Economic Growth and Environment, and Human Investment.

Note that the tasks in the SOW do not include an evaluation of past or current conservation activities that USAID/EI Salvador has financed previously or the design of conservation activities that USAID/EI Salvador may finance in the future.

## **C. STRUCTURE OF THE REPORT**

The report has the following sections:

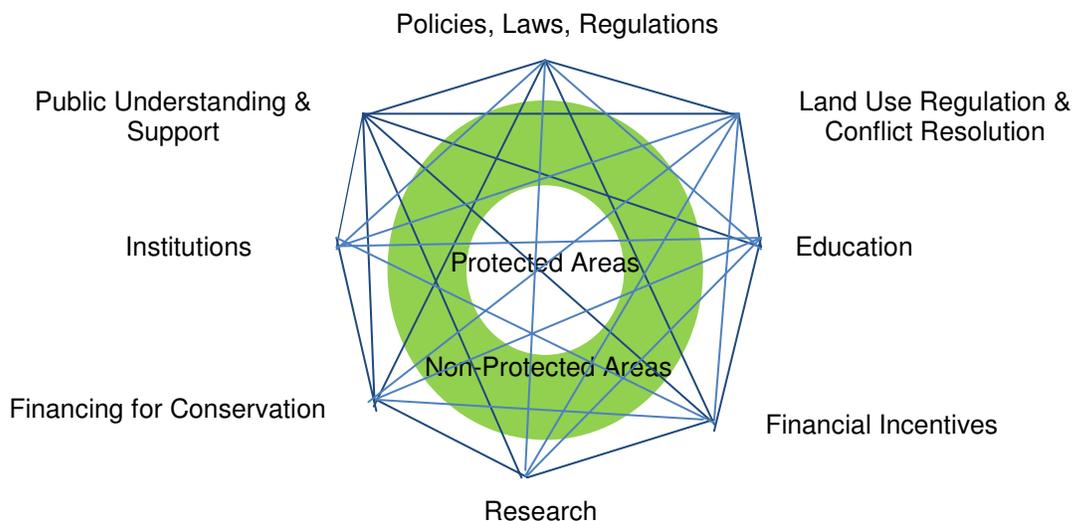
- Section I states the reports purpose, describes the methodology used for its preparation, identifies the principal gaps in the information that was available and summarizes USAID/EI Salvador's proposed strategy for the period from 2010 to 2014.
- Section II provides an overview of El Salvador's physical and social geography.
- Section III summarizes the current status of El Salvador's tropical forests and biodiversity.
- Section IV describes and analyzes the principal direct and indirect threats to El Salvador's tropical forests and biodiversity.
- Section V describes and discusses the priority actions that are required to conserve El Salvador's tropical forests and biodiversity.
- Section VI summarizes the report's principal conclusions and recommendations.

## D. METHODOLOGY

To define a conservation strategy requires that priority actions be selected from among many possible actions. The actions that are necessary in order to conserve El Salvador's tropical forests and biodiversity, however, are complex and inter-related. It is rarely possible, moreover, to define exact causal links between possible actions and conservation results. It is thus very difficult to select a coherent set of priority conservation activities.

In order simplify USAID/EI Salvador's selection of priority activities, ten categories of conservation actions were defined *a priori* in this report. These actions were considered to cover the range of conservation actions that are required in all countries in order to conserve forests and biodiversity. They are the following: (1) conservation within protected areas; (2) conservation outside of protected areas; (3) appropriate policies, laws, and regulations; (4) sufficient research; (5) education of conservation professionals; (6) strong public and private institutions; (7) effective land use planning and conflict resolution; (8) public support; and (9) financial incentives for conservation; and (10) sufficient and reliable financing for conservation institutions. These actions inter-act with each other, as graphically represented in Figure 1, although the precise nature, scope and intensity of their inter-actions is difficult to define.

**Figure 1 Graphical representation of links between ten categories of required conservation actions**



Based on interviews with knowledgeable people, field observations, and a review of reports and papers, the consultants defined, as best they could give the limitations of time and information, the current status in El Salvador of these ten conservation actions. Based on that information, as well as their own professional experience, the consultants selected the principal issues which need resolution in order for El Salvador to be able to conserve its tropical forests and biodiversity. They then formulated their recommendations to USAID/El Salvador for supporting the priority actions that they believe would be most effective in assisting El Salvador to resolve those principal issues. In order to give the recommendations a financial dimension, the consultants estimated a budget for each priority action.

## **E. GAPS IN INFORMATION**

Some of the gaps in the information available for this report reflect the non-existence of the information. Little is known, for example, about the populations, genetic variability and geographic distribution of many of El Salvador's threatened species. Likewise, there is almost no quantitative information about the current condition of El Salvador's terrestrial and aquatic habitats in its protected areas. The geographic location and species composition of El Salvador's secondary forests have not been studied in any detail. No ecosystem level data, such as water or nutrient flows, has been collected in any of El Salvador's protected areas.

Other information may exist but was not available for the preparation of this report or was of questionable reliability. The Ministry of Environment and Natural Resources (MARN) and other public and private conservation institutions made few quantitative data available about their budgets or personnel. Objective evaluations were lacking of most of the conservation activities that USAID/El Salvador has financed in the past. The information on the size, location, and condition of the component protected areas of the National System of Protected Areas (SANP) was sometimes quite contradictory.

## **F. USAID/EL SALVADOR COUNTRY STRATEGY FY 2010 - FY 2014**

At the time of the preparation of the report, USAID/El Salvador had not completed its country strategy for FY 2010 to FY 2014. The staff of USAID/El Salvador, however, provided the following summaries of the activities that would probably be financed during the period from 2010 to 2014.

### **1. Governing Justly and Democratically**

USAID/El Salvador will continue to assist El Salvador to reduce corruption and crime and strengthen the rule of law. Its financing will be used to improve the transparency, efficiency and timeliness of El Salvador's judicial system, promote the use of alternative dispute resolution mechanisms, reduce the numbers of youth joining gangs, make local government operations more transparent and accountable, and increase the accountability and responsiveness of local government. The only construction projects to be financed under this strategic objective will involve the rehabilitation of about 23 buildings for use as courthouses and mediation centers.

### **2. Investing in People**

USAID/El Salvador will assist the Ministry of Education to improve the effectiveness of grade school and high school teachers. Its assistance will improve the teacher training curriculum used by the University of El Salvador by emphasizing integrated, inter-disciplinary teaching

methodologies. Under the strategic objective, the skills of language teachers will be improved in 580 rural primary schools. USAID/El Salvador will not finance the construction of new schools but may finance the rehabilitation of existing schools.

USAID/El Salvador will assist the Ministry of Health to improve and decentralize El Salvador's health care services. It will finance activities to train primary health care providers, increase community involvement in health care, improve reproductive health practices and educate the public about HIV/AIDS. The only type of construction it will finance will involve improvements to the plumbing systems of buildings used for educational programs.

### **3. Economic Growth**

USAID/El Salvador will finance activities to strengthen the capabilities of El Salvador's public institutions to promote more equitable economic growth and the ability of its educational institutions to prepare a more educated and trained labor force.

## **II. EL SALVADOR'S GEOGRAPHY**

### **A. PHYSICAL GEOGRAPHY**

#### **1. Topographic and Geologic Zones**

El Salvador is located in Central America between Guatemala to the west, Honduras to the north, Honduras and Nicaragua to the east, and the Pacific Ocean to the south. It has a maritime zone and the three terrestrial zones. Its total terrestrial area is 2,104,100 ha.

#### **Maritime Zone**

The Maritime Zone extends 200 km from the coastline. The width of its continental shelf varies from under 25 km in the western portion near the Guatemalan border to about 110 km in the eastern portion, facing the Gulf de Fonseca (Baxter, S. 1995). The continental shelf's only topographic features are a few rocky outcrops. Fine sediments cover the sea floor closer to river outlets. The sea floor further away from river outlets is usually sandy, although when hurricanes and the El Niño climatic event occur they disperse muddy sediments over wide areas of the sea floor. The Equatorial Counter Current and the California Current flow parallel to the coast.

#### **Coastal Zone**

The Coastal Zone extends east from the border with Guatemala to the Bay of Fonseca, except where the coastal mountains reach the ocean, and then to the north and northeast to the outlet of the Goascorán River, on the border with Honduras. Its alluvial plain varies in width from 25 km. at the outlet of the Lempa River, in its center, to 15 to 30 km. in the southwest and five km. in the southeast. There are three mountain ranges in the Coastal Zone, the Cordillera de Tacuba furthest to the west, the Cordillera de Balsamo in the center and the Colinas de Jucuarán in the southeast. They are composed of highly eroded and deeply dissected lava rocks of the Pliocene.

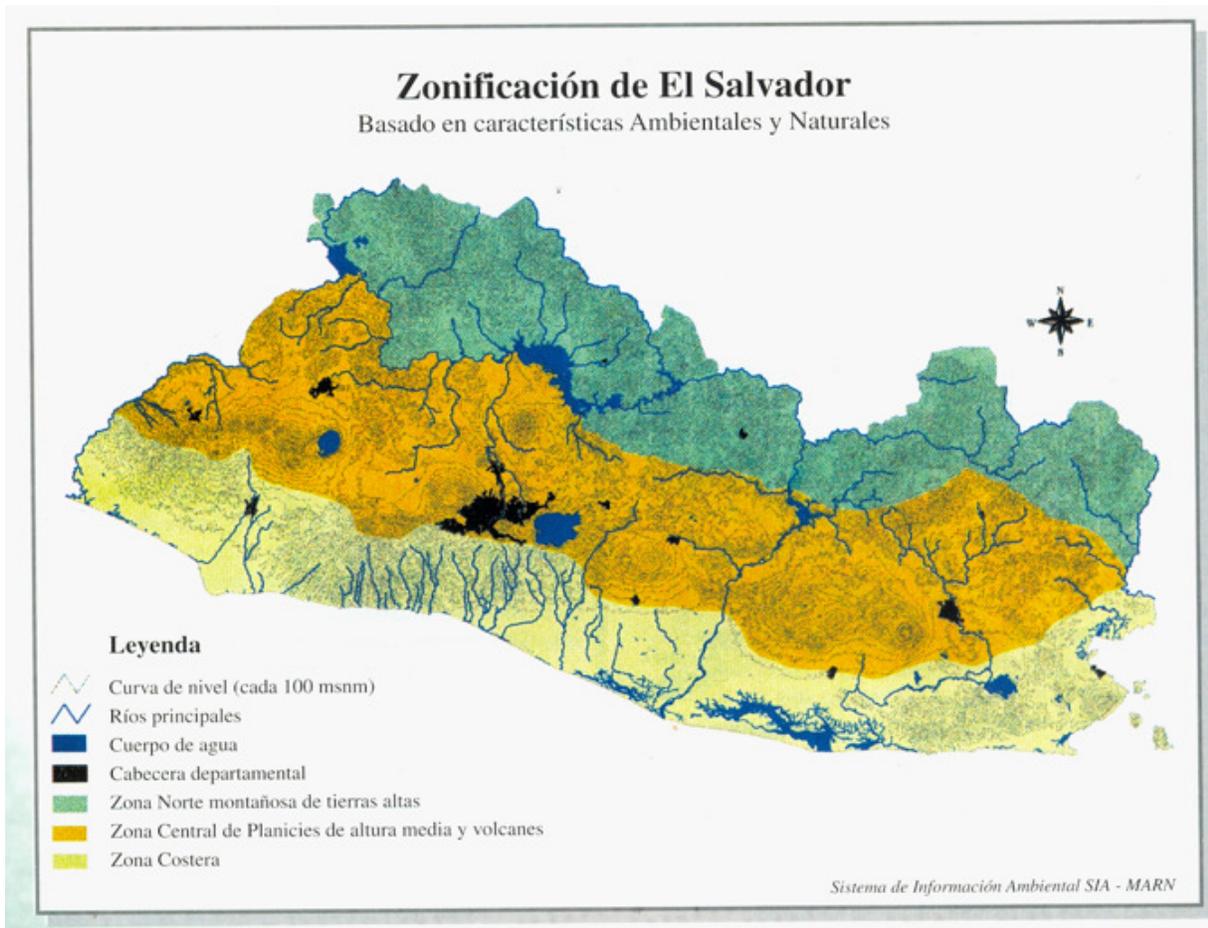
#### **Central Plain and Volcanic Zone**

The Central Plain and Volcanic Zone has 50 active volcanoes. They occur within five volcanic complexes: Santa Ana, San Salvador, San Vicente, Tecapa-San Miguel, and Conchagua-Gulf of Fonseca, which are separated by structural basins. The basins are composed of collapsed

and eroded Pliocene volcanic materials overlain by Quaternary alluvium and pumice deposits. The movements along the zone's numerous fault lines frequently cause earthquakes.

### **Northern Mountains Zone**

The Northern Mountains Zone lies along El Salvador's northern border with Honduras and Guatemala. Mesozoic folded and faulted sedimentary rocks form the mountains in this zone form the highest peaks in El Salvador, Montecristo (2,418 meters) and Cerro Miramundo (2,394 meters). Much of the zone is highly eroded.



**Map 1. The three terrestrial zones of El Salvador**

## **2. Soils**

Table 1 indicates the seven major soil types in El Salvador according to the classification system of the U.S. Department of Agriculture (USDA).

**Table 1 USDA classification of El Salvador's soil types**

Group	Characteristics	Area Km <sup>2</sup>	Percent
Reddish clay alfisoles	Located in the volcanic range & formed from recent basaltic and andesitic lava. Moderate to low fertility & often eroded. Generally unsuitable for agriculture	7,387	35
Old acid clay Alfisoles	Located in the northern mountains and formed from ancient rocks above 800 meters above sea level. Moderate to low fertility. Generally unsuitable for agriculture.	422	2
Litsoles	Very shallow soils over a rock substrate; usually low fertility. Chaparrals are only primary vegetation. Unsuitable for agriculture.	4,010	19
Regosoles	Located in hilly areas or coastal flatlands, of loose materials. Very (volcanic) to moderately (sandy) fertile. Often suitable for agriculture.	4,221	20
Alluviales	Located on flat areas adjacent to rivers and along the coast. Fertile. Often suitable for agriculture but with risk from flooding.	3,166	15
Grumosoles	Located in dispersed valley bottoms. Very fine clays and poor drainage, Moderate to low fertility. Morrales is typical vegetation Suitable for rice cultivation.	1,266	6
Andisoles	Most fertile, well drained soils. Located on the slopes of volcanoes above 600 meters above sea level from pyroclastic material. Fertile to very fertile. Often suitable for agriculture and coffee.	633	3
<b>TOTAL</b>		<b>21,106</b>	<b>100</b>

Source: Guevara, J. et al, 1983; Rico, M., 1995 & 2009

Table 1 indicates that the most widespread soil type in El Salvador is the reddish clay alfisoles of the central volcanic zone. The litsoles and regosoles are the next most common soil types followed by alluvial soils and then by much smaller areas of grumosoles, andisoles and old acid clay alfisoles. The best soils for agriculture in El Salvador, according to the USDA classification system, are generally andisoles. Table 2 indicates the eight classes of soils in El Salvador according to the FAO classification.

**Table 2 FAO classification of El Salvador's soils**

Class	Description	Area Km <sup>2</sup>	Percent
<b>I</b>	No limitations for use (flat, fertile, well-drained).	823	3.9
<b>II</b>	Require careful use and moderate conservation measures	992	4.7
<b>III</b>	Some limitations for intensive use, requiring expensive conservation measures.	1,667	7.9
<b>IV</b>	Severe limitations that restrict crop choice. Difficult and expensive conservation measures required	3,335	15.8
<b>V</b>	Suited only for permanent crops or vegetation; not subject to erosion	454	2.2
<b>VI</b>	Though often productive to highly productive, suitable only for permanent vegetation such as forests, fruit trees, prairies.	2,005	9.5
<b>VII</b>	Severe and permanent limitations	8,569	40.6
<b>VIII</b>	No agricultural possibilities. Protective forestry,	2,533	12.0

Class	Description	Area Km <sup>2</sup>	Percent
	wild lands, recreation.		
<b>Unmapped</b>	Mainly in mountainous northern – north-eastern border of El Salvador, in Classes VI, VII and VIII	718	3.4
<b>TOTAL</b>		21,106	100

Source: Rico, M. 1986 & 2009

Table 2 indicates that according to the FAO land classification system 13.5 percent of El Salvador's soils (3,482 km<sup>2</sup>) is Class I, II, III, suitable for agriculture, and 15.8 percent is Class IV, soil that can be used for non-mechanized agriculture. Sixteen percent (3,329 Km<sup>2</sup>) is Class IV soil, suitable for non-mechanized agriculture, and the remaining 70.7 percent (14,279 km<sup>2</sup>) is suitable only for tree crops and forest (Rico, 1986).

The USDA classification system reflects the geological origins of soils as influenced by climate and hydrology. This system permits only limited conclusions about the best use of the different types of soils. The FAO system, by contrast, classifies soils on the basis of their agricultural potential. Thus two different soil groups in the USDA system could be in one group under the FAO system.

As a small, densely populated country, El Salvador should concentrate its investments in agriculture and livestock on those soils that will return the highest return in production and let soils with little potential for agriculture or pasture remain in forest. Both the USDA and FAO systems of soil classification classify about half of El Salvador's soils as unsuitable for any use other than forests. Reserving certain areas in El Salvador for the protection of biodiversity and forests, therefore, does not conflict with El Salvador's need for pasture and agricultural land. The data on soils clearly indicate that there is sufficient land in El Salvador for protection of biodiversity and forests as well as for agriculture and livestock production. Indeed, forests on steep slopes protect water supplies for energy production, irrigation, industry and domestic use. Both classifications of El Salvador's soils clearly indicate that production and protective objectives for El Salvador's soils, forests and biodiversity are complementary rather than contradictory.

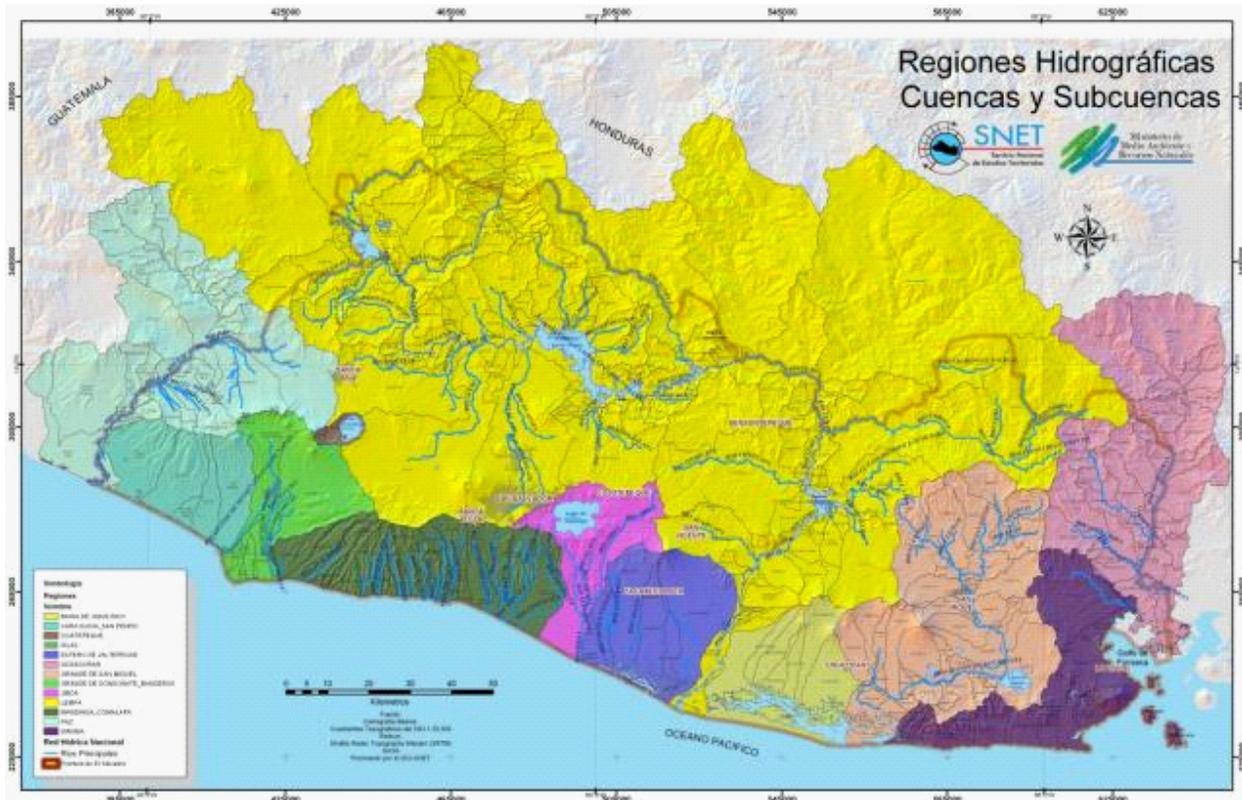
### 3. Climate

El Salvador has a tropical climate with an average annual temperature of 22 to 28 degrees C. Average annual precipitation varies from 1,300 mm per year in the interior valleys to 3,000 mm per year at the highest elevations. Ninety percent of the rain falls between May and October and the dry season is from November to April, although it can vary by several weeks from one year to the next. Rainfall associated with Pacific and Caribbean hurricanes account for a large portion of El Salvador's annual precipitation and frequently cause severe floods, landslides and soil erosion. The combination of long dry and wet seasons creates conditions that are propitious for large wildfires to occur.

### 4. Hydrological Regions

The National Service for Territorial Studies (SNET) has divided El Salvador into eleven major watersheds, as shown on Map 2. The largest watershed is that of the Lempa River (yellow), which covers approximately 50 percent of El Salvador. To its east are the watersheds of the Rios Goascorán (darker pink), the Río Grande de San Miguel (lighter pink) and the Jucuarán (dark purple). From the Guatemalan border on the west moving towards the east, are the watersheds of the Rios Paz (light green-blue), the Entre Paz-Sonsonate (darker green-blue), the

Río Grande de Sonsonate (light-green), the Entre Sonsonate-Jiboa (dark-green), the Río Jiboa (dark pink), the Entre Jiboa-Lempa (blue) and the Entre Lempa- Grande de San Miguel (tan).



**Map 2. Hydrographic regions, watersheds and sub-watersheds in El Salvador (SNET, 2009)**

El Salvador's larger rivers flow all year, but the volumes of smaller rivers fluctuate a great deal and may dry up during the dry season. Most rivers carry large loads of sediment as the result of erosion in their watersheds, and the streams of the coastal mountains have carved deep canyons.

El Salvador's principal natural lakes are the Ilopango, Coatepeque, Chanmico, Aramuaca, La Caldera, and Las Brujas. They all occupy volcanic calderas. The Cinco de Noviembre Dam on the Río Lempa, built in 1952, created a lake of 20 square kilometers. Most of the lakes have high turbidity due to the soil erosion on the surrounding mountainsides. Their water sometimes contains chemicals released by volcanic gases (Daugherty, H., 1973). The shallowest and most biologically productive lakes, Olomega and Guija and Jocotal, also are the most eutrophic lakes (Ventura, C. 1995).

## **B. SOCIAL GEOGRAPHY**

### **1. Demography**

The population of what was to become El Salvador was about 475,000 in 1524 when it was conquered by the Spanish. European diseases decimated the indigenous population, and by

1551 it had fallen to about 60,000. El Salvador's population grew slowly through the seventeenth and eighteenth centuries, reaching 175,000 in 1800. By 1900, however, it had grown to 775,000, and rapid population growth continued through the 1970's when El Salvador's population exceeded 3,350,000 (Daugherty, 1969). The population growth rate began to slow during the 1980's and in 2005 was estimated to be 1.7 per cent per year, compared to over 3 percent in the 1960's. The 2007 national census in 2007 indicated that El Salvador had a population of 5.74 million. Its population density of 272 people per square kilometer is the highest in the Americas.

Internal rural to urban migration and external migration to the United States has been rapid over the past three decades. Fifty-eight percent of the population now lives in urban areas. San Salvador, the capital is El Salvador's largest city, with a population of 2.2 million people, followed by Santa Ana and San Miguel. As of 2004, there were 2.95 million Salvadorans living outside El Salvador, about 95 percent of them living in the United States (Garcia, J.J., per. com., 2009).

Ninety percent of Salvadorians call themselves mestizo, descendents from both Europeans and the original indigenous people. Although El Salvador is often described as a country without any indigenous peoples, two to five percent of the population calls itself indigenous. They are descendents of the Pipil, Lenca and Kakawira groups that were the inhabitants of El Salvador's territories at the time of the Spanish Conquest (Tilley, V.Q., 2005). El Salvador is the only Central American country that has no population of African descent (Guevara, M. et al, 1983).

## 2. Land Use

The hunters and gatherers and farmers who inhabited the territory of El Salvador before the Spanish Conquest greatly influenced its forests and biodiversity by hunting, burning and clearing (Daugherty, 1969). The drop in the population after the Conquest resulted in abandonment of agricultural land and the regeneration of forest in some areas (Hecht, et al, 2006). As the Spanish became established, their extensive methods of ranching and cultivating indigo stimulated the burning and clearing of large areas of forest. Daugherty (1969) concludes that by 1800 "...most of El Salvador had been significantly altered by human activity and some parts of the country had been ecologically devastated."

The forests of the central volcanic highlands began to be cleared in the 1830's to plant coffee, and the forests of the northern mountain region continued to be cleared during the mid-twentieth century for agriculture and pastures. The coastal plain forests were cleared starting in the 1940's, mostly to establish sugar cane and cotton plantations. Part of the coastal mangrove forests was converted to shrimp plantations in the 1970's. During the 1990s many rural people stopped using their rural properties for agriculture and pasture. Consequently, some former fields and pastures began to regenerate to secondary forest (Hecht, S. and S. Saatchi (2005). Table 3 shows the land uses in El Salvador for the years 1979, 2006 and 2008.

**Table 3 Land use in El Salvador 1979, 2006 and 2008**

Land Use	1979		2006		2008	
	Ha ('000)	%	Ha ('000)	%	Ha ('000)	%
<b>Agriculture</b>	<b>664.8</b>	<b>31.6</b>	<b>571.9</b>	<b>27.7</b>	<b>612.2</b>	<b>29.7</b>
Annual Crops	406.5	19.3	331.1		364.3	
Basic Grains	n.d.	n.d.	315.5	15.3	349.6	17.0
Agro industrial Crops	n.d.	n.d.	4.6	0.2	2.7	0.1

Land Use	1979		2006		2008	
	Ha ('000)	%	Ha ('000)	%	Ha ('000)	%
Horticultural Products	n.d.	n.d.	11.0	0.5	12.0	0.6
Semi Permanent Crops	39.3	1.8	66.7	3.2	73.1	3.5
Permanent Crops	219.0	10.4	174.1	8.5	175.4	8.5
<b>Pasture</b>	<b>522.4</b>	<b>24.8</b>	<b>586.6</b>	<b>28.5</b>	<b>591.5</b>	<b>28.7</b>
<b>Forest</b>	<b>262.4</b>	<b>12.5</b>	<b>337.2</b>	<b>16.4</b>	<b>337.2</b>	<b>16.4</b>
Natural Forest	217.1	10.3	304.3	16.4	304.3	16.4
Mangrove Forest	45.3	2.2	32.9	1.6	32.9	1.6
<b>Idle Land</b>	<b>559.9</b>	<b>26.6</b>	<b>336.9</b>	<b>16.4</b>	<b>288.4</b>	<b>14.0</b>
<b>Other Uses</b>	<b>94.6</b>	<b>4.5</b>	<b>227.4</b>	<b>11.0</b>	<b>230.1</b>	<b>11.2</b>
<b>TOTAL</b>	<b>2104.1</b>	<b>100</b>	<b>2060.0</b>	<b>100</b>	<b>2060.0</b>	<b>100</b>

Source: MAG, 2009; DGEA, 1979, 2006, 2008

Table 3 indicates that the area of land in some type of agriculture decreased between 1979 and 2008, from 664,800 ha to 612,200 ha, a decrease of 52,600 ha. The area of pasture increased from 522,400 ha to 591,500 ha, an increase of 69,100 ha. The area of natural forest increased from 262,400 ha to 337,200 ha an increase of 74,800 ha. If the decrease of 12,300 ha in the area of mangrove forest is not included, however, the increase in natural forest was 87,200 ha.

The greatest differences between the land uses in 1978 and 2008 were in the categories of Idle Land and Other Uses. Idle Land decreased from 559,900 ha to 288,400 ha, a decrease of 271,500 ha and Other Uses increased from 94,600 ha to 230,100 ha, an increase of 135,500 ha. It is possible, however, that these two changes in land use reflect a different methodology for classifying land rather than a substantial change in land use.

Between 1979 and 2006 the land in agriculture went down from 31.6 to 27.7 percent, but the percent rose again to 29.7 percent in 2008. The area of pasture, by contrast, rose steadily during this period, from 24.8 percent in 1979, to 28.5 percent in 2006, to 28.7 percent in 2008. The area of forest stayed the same at 16.4 percent, while the area of idle land went down from 16.4 to 14.9 percent.

### 3. Risks of Natural and Human Origin

El Salvador is a risky country. Earthquakes, tropical storms, volcanoes, flooding and landslides occur frequently. These risks have been increased by the clearing of forest on steep slopes. Soil erosion affects approximately 75 percent of El Salvador's territory and causes the loss of 59 million metric tons of soil per year. The scope and intensity of this soil erosion increases the risk from flooding, landslides and drought by reducing the volume of topsoil and thus its capacity to retain water during and after heavy rainfall, especially the tropical storms that occur frequently in El Salvador. The National Service for Territorial Studies (SNET) estimates that about 1,970 km<sup>2</sup>, is at risk from severe or moderate impact from flooding, 4,040 km<sup>2</sup> are vulnerable to landslides and 10,000 km<sup>2</sup> could experience drought (<http://snet.gov.es>, 2010)

### 4. Economy

Although the smallest country in Central America, in 2009 El Salvador had its third largest economy. With the adoption of the US dollar as its currency in 2001, El Salvador has been forced to maintain a disciplined fiscal policy. El Salvador's largest source of foreign exchange, averaging over \$2 billion a year, is remittances from El Salvadorians who have emigrated to the United States (RTI International, 2009). In 2006 El Salvador was the first country to ratify the Central America-Dominican Republic Free Trade Agreement (CAFTA/DR). CAFTA/DR has

bolstered the export of processed foods, sugar, and ethanol, and attracted foreign investment in manufacturing. El Salvador has promoted an open trade and investment environment, and has sold off its publically owned telecom, electricity distribution, banking, and pension funds to the private sector (<https://www.cia.gov/>). President Saca's administration sought to diversify the economy, with an emphasis on becoming a regional transportation hub and increasing international tourism. In late 2006, the government and the Millennium Challenge Corporation signed a five-year, \$461 million agreement to stimulate economic growth and reduce poverty in the country's northern region, where more than 44 percent of the population still lives in poverty (RTI International, 2009). The MCC funds will be invested in education, public services, enterprise development, and transportation infrastructure (FOMILENIO. 2010).

## **5. Land Reform**

Prior to 1992, there were four attempts at agrarian reform in El Salvador. 1931 President Arturo Araujo attempted to resolve social problems and stop violent demonstrations by introducing some reforms in the agrarian sector. The failure of this attempt led to his overthrow and a military dictatorship. After the Soccer War with Honduras in 1969, the government acknowledged that one of the war's principal causes was the country's inequitable distribution of land. In 1970, it organized the First National Congress of Agrarian Reform, which identified the concentration of land in the hands of the few as a barrier to full employment and the development of natural resources. Instability in the government, however, prevented a thorough land reform at that time. The third attempt at agrarian reform came in 1972. About 61,000 hectares were to be nationalized and divided among 12,000 rural families. The government established the Salvadoran Institute of Agrarian Reform (ISTA), which began to implement a land reform process very slowly.

In 1980, the fourth attempt at agrarian reform was started. Its first phase nationalized 376 haciendas with more than 500 hectares that were mainly in livestock, cotton and coffee production. The second phase was intended to nationalize 200 haciendas of coffee plantations between 100 and 500 hectares in size, but it was revised in 1983 to cover only areas with from 245 to 500 ha. The last phase mandated that all rented land be turned over to those who cultivated it. Though never fully implemented, the last phase did provide considerable areas of lands to formerly landless rural poor. Through March 1984 the land reform had transferred and legalized the title to 250,069 ha. Previous to 1982, ISTA had already purchased 92,847 ha, so the total area of the land reform was 331,659 ha, equivalent to 15.8 % of the national territory ((MARN, 2002).

The Peace Accords of 1992 included strict stipulations for land reform. In compliance with these provisions, the government started to implement the latest phase of land reform in El Salvador. The Program for Transferred Land (PTT) was intended to provide land titles and financing to former military and guerrillas utilizing land donated by or purchased from large landowners. The government also established a Land Bank and issued 40,000 land titles (30,000 for ex-combatants of the FMLN and 10,000 the military). In 1996, the government organized the First Annual Conference of Land in El Salvador. Its purpose was to discuss the damage to El Salvador's environment caused by inequitable distribution of land and to formulate means to reduce this damage. The conference led to full autonomy for the Ministry for the Environment and Natural Resources (MARN) and the passage of the Law of Protected Natural Areas and the Law of the Environment.

The first phase of the 1980 agrarian reform had enormous implications for conservation in El Salvador. The large properties that were broken up under its provision contained 54 percent of

El Salvador's remaining primary forests (Guevara Morán et al, 1983). Once the armed conflict terminated, however, the transfer of these areas to the national government, as was required by the Agrarian Reform Law, was given low priority by the government. As of November 2009, of the 144 properties that had been reserved as public protected areas, only 53 had been legally transferred from ISTA to MARN. Most of those transfers have been made since 2000. Consequently, many of these potential protected areas have been invaded by rural people and their vegetation eliminated or degraded. Currently, ISTA has almost none of the financial, technical or material resources that would be required to complete the process of transferring the remaining protected areas to MARN (Albanez, per. com., 2009).

## **6. Government and Politics**

El Salvador is a democracy with a federal government. Its 14 departmental governments have appointed officials and relatively few responsibilities. Its 262 municipalities, by contrast, traditionally have been independent in their functions from the central government and are administered by elected mayors and municipal councils.

Until the 1980's a small number of powerful, elite families dominated El Salvador's politics and government. The agrarian reform in the 1980's reduced their influence in politics. Since 1992, El Salvador has held five free and fair elections. The ARENA party won the elections of 1989, 1994, 1999 and, 2004 and implemented policies that emphasized decentralization, strengthening the private sector and expanding export markets. Campaigning on a political platform of increasing the role of the state, attaining agricultural self-sufficiency and alleviating poverty, the Farabundo Marti Front for National Liberation (FLMN) party won the 2009 elections and will govern until 2014. When this report was being written, the FLMN government was still in the process of developing the policies and actions that it will implement during its period of government.

### **Box 1. Success Story: Protecting biodiversity by intensifying agricultural production**

Conserving biodiversity does not necessarily require sacrificing food production. From 1982 to 1984, USAID, through an Employment Generation Program, financed the Salvadorian Institute of Natural Renewable Resources (ISREN) to increase production on an Agrarian Reform farm called farm Singaltique, located near Chapeltique in the Northern part of the San Miguel Department, then deep in territory controlled by anti-government guerrillas. Rice was identified as the best crop for the farm's flat, poorly-drained, heavy clay soils, even though production was, at that time, only 18 bushels per hectare once a year, compared to a national average of 55 bushels per hectare. Thus, of 13 rice producing areas then known to exist in El Salvador, this was the worst.

Within 24 months rice production per hectare per year was increased from 18 to 209 bushels and the sale price of the rice increase 400 percent! How was this accomplished? Rice yield increased because of excellent, intensive technology. Combining the skills of professionals in irrigation, soils, hydrology, rice production and marketing, the soil was enriched, levelled and terraced; irrigation water was applied in at the right time in correct amounts; improved seeds were planted; insects and diseases were controlled; rice prices increased because the improved quality and quantity of rice made it possible for the farm to by-pass intermediaries and negotiate high prices directly with large-scale buyers.

The Singaltique example is not an isolated case. In the early 1980's, when soil conservation efforts in northern Chalatenango, infamous for its poor soils, concentrated on improving agricultural yields rather than fighting soil erosion, grain yields increased by 300 to 2,500 percent. And soils were improved at the same time.

Yes, El Salvador is a small country whose soil and forests have been devastated. Yet it is still a country wealthy in natural resources. Climatic and soil conditions for both biodiversity and agriculture remain potentially fabulous. Most of all, its people are capable of learning and applying technology to intensify agriculture and livestock production on the most suitable land so that El Salvador's need for food production can be met amply and profitably, while leaving large areas of natural habitat for the protection of its tremendous variety of plants, animals and other organisms.

### III. STATUS OF EL SALVADOR'S BIODIVERSITY AND TROPICAL FORESTS

#### A. EL SALVADOR'S BIODIVERSITY

##### 1. Ecosystem Biodiversity

It is inherently difficult to classify ecosystems since their boundaries depend on the choice of scale (Bissonette, J., 1995). No classification has been made or mapped of El Salvador's ecosystems at any scale, based on such variables as their stability through time, interactions between plant and animal species, characteristics of geochemical cycles, or water flows and watershed boundaries. In the absence of an ecosystem classification of El Salvador, classifications of vegetation communities can be used as indicator of, or proxy for, ecosystem diversity.

El Salvador's terrestrial vegetation has been classified in a number of ways, but two are particularly useful and widely cited. The Lauer (1953) classification is based on direct observation of existing natural vegetation. The Holdridge (1979) classification predicts potential vegetation based on observed temperature, precipitation and evapotranspiration. Table 4 lists the vegetation communities in El Salvador according to these two classifications.

**Table 4 Two classifications of El Salvador's vegetation communities**

Holdridge Life Zone	Lauer Vegetation Community Classification
Subtropical very humid forest	Humid lowland forest
Tropical humid forest	Cloud forest
Sub-tropical humid forest	Mangroves
Tropical dry forest	Deciduous semi-humid forest
Subtropical low montane very humid forest	Chaparral
Subtropical montane very humid forest	Morrall
	Semi-humid savannah
	Beach vegetation
	Gallery Forests
	Pine-oak forest
	High savanna

Source: Holdridge, 1978, Lauer, 1954

In the Holdridge Life Zone classification El Salvador has six life zones, all of them dominated by trees. The Lauer classification identifies 11 vegetation communities. Of these, nine are forest communities and two are non-forest vegetation. For field work, the Lauer vegetation classification is generally more useful than the Holdridge classification because plant species can be observed more readily than climatic variables.

It was not possible for this report to obtain the area of each type of Holdridge Life Zone or Lauer vegetation community. Map 3, however, indicates the original geographic distribution of Lauer's classification of El Salvador's vegetation communities. The vegetation community with by far the largest area and widest distribution was the semi-humid deciduous forest, shown on the map with a grey-blue color. Within this vegetation community there is a range from more deciduous

to less deciduous forest depending on the average annual humidity of particular regions or sites. For example, the over 70 percent of the tree species are deciduous in the Deininger National Park, on the outskirts of the coastal city of La Libertad, where there is relatively low precipitation, cloud cover and relative humidity. By contrast, less than 20 percent of the tree species in the higher parts of the El Imposible National Park, where precipitation, cloud cover and relative humidity are higher, are deciduous, although the forest there is also classified as semi-humid deciduous. Most of the semi-humid deciduous forest vegetation has been eliminated or severely altered and mostly replaced by pasture, annual crops and coffee.

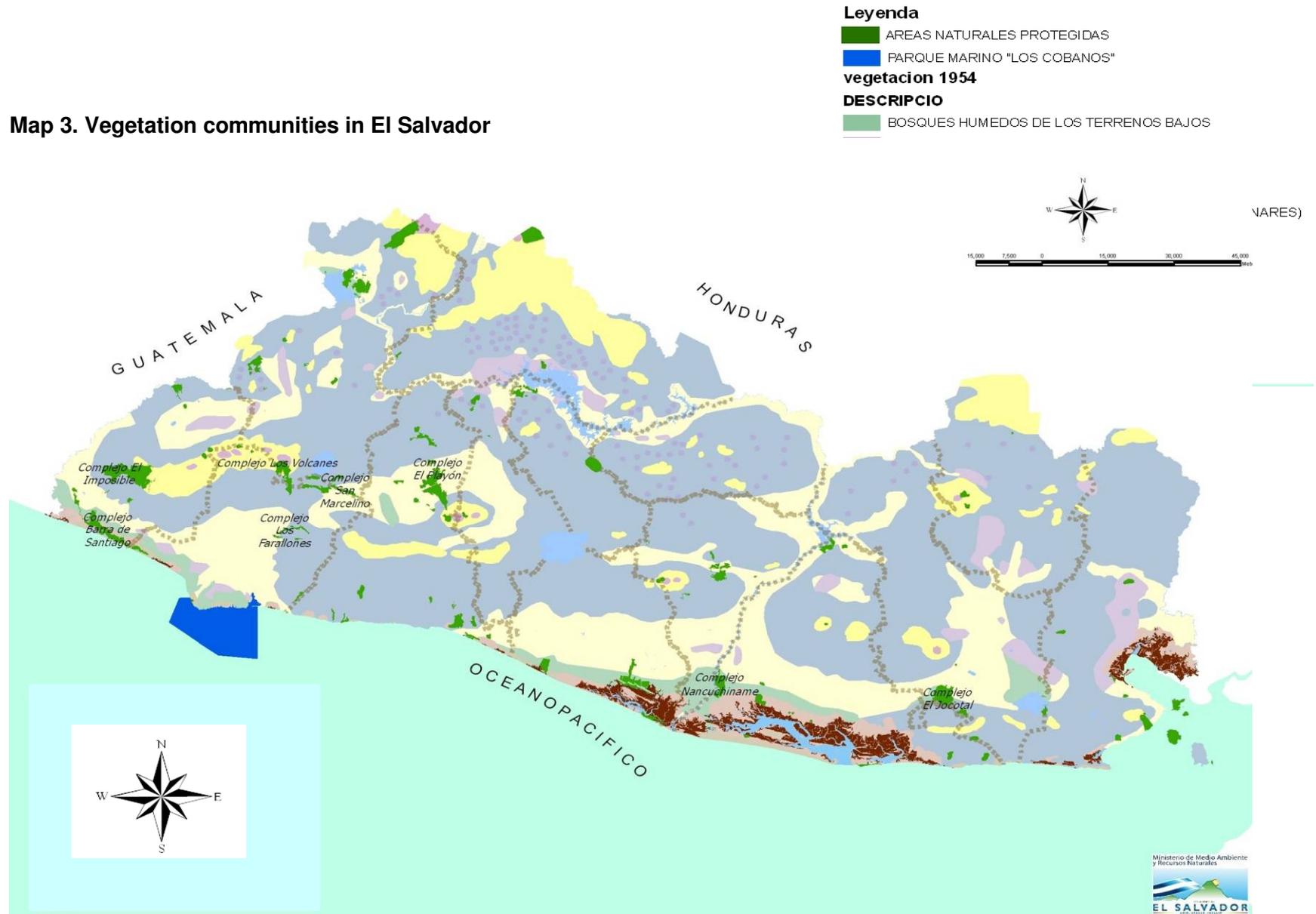
The semi-humid savannah, shown in light yellow on the map, was the second largest vegetative community in El Salvador. It was located mostly on flatter sites within or surrounding semi-humid deciduous forest. Pasture, sugar cane, and cotton have replaced most of this vegetative community.

The pine-oak vegetative community, shown on the map in darker yellow, was almost as extensive as the semi-humid savannah. It was mostly located on the slopes of the volcanoes and in the Northern Mountains Zone. Most of the pine-oak forests that formerly grew on the volcanic slopes has been cleared to establish coffee plantations. In the Northern Mountain Zone, much of the pine-oak vegetation community has also been eliminated for crops and pasture. In the last two decades, however, the area of pine-oak vegetation may have expanded as it regenerated on abandoned pastures and fields.

The mangrove community, shown in dark red on the map, occurs in the estuaries of eastern and central El Salvador. Large areas of mangroves still remain. The other vegetation types shown on the map had small areas and occurred in only a few places. Only small patches of them remain.

The total area of primary forest in El Salvador, its location and the size of its individual blocks are the most important indicators of the status of El Salvador's terrestrial biodiversity. The species composition and vegetation structure of primary forests remain stable over long periods of time, with only occasional disturbance caused by wind throw. Individual plants germinate, grow to maturity, and die, but no drastic changes occur in the forest's plant species composition and in the forest's structure. This stability of the primary tropical semi-humid, humid and rain forests is one of the main reasons for its high diversity of species of plants, animals and other groups of terrestrial organisms (Leigh, E.G., 2002).

**Map 3. Vegetation communities in El Salvador**



These estimates of primary forest in El Salvador do not include any of its mangrove forest, *morral*, chaparral, or the parts of the pine-oak forest vegetation type that are dominated by pine. The estimates exclude the mangrove forest because, although perhaps 60 percent or more of it could be considered primary, its inclusion would give a distorted perspective how small the total area is in El Salvador of fully terrestrial primary forest. The parts of the pine-oak vegetation that are dominated by pine, are almost always the result of disturbance, either by fire or exploitation for firewood, and do not have the stability or diversity that characterizes primary forest. Almost all the *morral* and chaparral vegetation communities have been heavily disturbed, making it almost impossible to difficult to distinguish accurately the parts of it that are primary vegetation.

For El Salvador's aquatic ecosystems there is no classification equivalent to that of Lauer or Holdridge for terrestrial ecosystems. Aquatic ecosystems could, however, be divided into the three general categories of fresh, brackish or salt water. They could be further sub-divided based their physical differences, such as depth, and chemical properties. A peculiar characteristic of El Salvador's aquatic fresh water lakes, for example, is that many of them occur in the calderas of semi-quiescent volcanoes, which release gases directly into their water. These gases vary in their chemical composition, thus influencing the chemical composition of the lake water and the lake's ecological processes. Similarly, the rate at which the lakes become eutrophic varies leading to considerable differences in their content of organic matter and biological productivity.

El Salvador's marine aquatic ecosystems are distributed along the continental shelf and the area beyond, out to its 200 nautical mile territorial limit. The characteristics of these ecosystems vary with such factors as the characteristics of the adjoining shoreline, their distance from the coast, the temperature and salinity of ocean currents, water depth and topography and geology. No systematic classification of these marine ecosystems has been published.<sup>1</sup>

## 2. Species Biodiversity

El Salvador's species<sup>2</sup> occur in the plant, animal, fungi, algae and protista kingdoms of living organisms. Its plants and animals have been more thoroughly studied than its fungi, algae and protista. El Salvador is part of the western Central American zoographic region, whose animal species migrated from South America and North America as well as evolving in Mesoamerica itself (Kohler, 2003). Its species diversity is less than that of the other Central American countries, both because its total area is smaller, and because it does not have the coastal rain forests of the other countries, in which species diversity is particularly high. No animal species have been identified that are endemic only to El Salvador. Seventeen of the 23 endemic species of birds reported in northern Central America, however, are still found in El Salvador (World Bank, 2005).

Table 5 summarizes the current knowledge about species biodiversity in El Salvador. The estimates of the numbers of species for many of the groups indicated in Table 4 were made for this report by the specialists who are currently studying these groups in El Salvador. These estimates are the most up-to-date and reliable estimates of the numbers of species currently available for these groups. For lack of more current data, however, the estimates of species

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<sup>1</sup> Juan Jose Orellana, El Salvador's leading expert on fishes, has described and analyzed some aspects of freshwater, estuarine and marine ecosystems although, unfortunately, his manuscript remains unpublished for lack of funding.

<sup>2</sup> A species is a population of organisms that can interbreed and produce viable young, fertile, and similar to their parents, in nature. A sub-species is a population of an organism that interbreeds in nature and produces viable young.

numbers for some of the groups, such as the grasses, are based on data that is several decades old.

The first column of Table 5 lists the major groups of living organisms. The second column indicates the total number of species that has been identified and reported for El Salvador within each group of organisms. The third column gives the reference for this estimate of the number of species. The fourth and fifth columns provide an estimate of the number of the species in each group that are considered threatened or endangered<sup>3</sup> in El Salvador and, therefore, are of particular concern for the conservation of its biodiversity.<sup>4</sup>

Table 5 indicates that at least 57,307 species of living organisms, including at least 50,000 fungi, live in terrestrial and aquatic El Salvador. The total number of species, however, is probably much larger, since it is not possible to determine the number of species in the protista, echinoderms, beetles, ants, wasps and bees and many other groups. The macroscopic groups with the greatest number of species are the trees (1,002), algae (600), orchids (521) and grasses (403). The animal group with the most number of reported species is the butterflies, with 709 species. Other animal groups with a large number of species are the fish (759), birds (548), and molluscs (481), and crustacean (191). There are fewer species of mammals (144), reptiles (99) and amphibians (32).

**Table 5 Number of species and endangered and threatened species in El Salvador**

Group	No. Species	Source	Threatened	Endangered
Protista	Not Det.	no references	ND	ND
Algae	600 aprox.	Gutiérrez, A. 1995	ND	ND
Fungi	over 50,000	Escobar & Orellana 1995	ND	ND
Lichens	294	Sipman, H. 2001.	ND	ND
Mosses	233	Menzel, Mario, 199	ND	ND
Cacti	9	N. Herrera, 2009	ND	ND
Ferns	252	J. Monterrosa et al, 2009	7	5
Grasses	403	Catterson et al, 2004	ND	ND
Trees	1002	W. Berehdnson, 2009; J. Linares, 2003	27	7
Orchids	521	Hamer, F. 1972 & 1978.	3	ND
Bromeliads	127	Berendsohn, 1993, Catterson et al 2004	4	1
Fish (marine & contint	759	Orellana, J.J., 2009	2	4
Cartilaginous	60	“ “	1	2
Bony	699	41 freshwater, 9 exotic fw	1	2
Amphibians	32	Köhler, Veselý & Greenbaum. 2006	6	12
Frogs, Toads	27	“ “ “	4	9
Salamanders	4	“ “ “	1	3

<sup>3</sup> The term “endemic” refers to a species with a distribution that is confined to a defined geographic area, often a country. For El Salvador these are mostly species found only in a biogeographic zone of Central America located between Southern Mexico and western Honduras. Some endemic “islands” may exist in El Salvador. In the cloud forest of Montecristo, for example, some species of insects have been collected that have not been found elsewhere. To confirm these species as endemic, it would be necessary to confirm that they do not occur in other countries.

<sup>4</sup> A “threatened” or “vulnerable” species is a species that is under threat. An “endangered” species is already at risk of extinction, because its population probably has become too small for the species to survive. In El Salvador quantitative criteria are not available for most species to differentiate between the two.

Group	No. Species	Source	Threatened	Endangered
Caecilians	1	“ “ “	1	
Reptiles	99	Köhler, Veselý & Greenbaum. 2006.	30	12
Crocodylians	2	“ “ “	0	2
Turtles	9 *	“ “ “	1	5
Lizards	30	“ “ “	9	2
Snakes	58	“ “ “	20	3
Birds	548	Komar, O. et al / SalvaNATURA. 2009	59	118
Mammals	144	Owen,J.J. 2009; MARN, 2009	35	19
Rodents	28	“ “		
Bats	63	“ “		
Other	43	“ “		
Butterflies	709	F. Serrano, 2009.	27	0
Annelida	127	MARN, 2009	ND	ND
Mollusca	481	MARN, 2009 & M.A.Hernández, 1995	1	1
Coelenterata	35	Gotuzzo, R. 1995, MARN, 2009	7	2
Crustacea	191	J.J.Orellana, 2009	ND	ND
Echinoderms	ND	No published inventories	4	0
TOTAL	>56,566		349	209

Source: MARN, 2009

The number of identified species and the reliability of the estimates of numbers of species in the different groups depend to some extent on how long and intensively the group has been studied. Thus the estimates for the number of species bird, mammal and butterfly species, which have been intensively studied for a long time in El Salvador, are more reliable than the estimates for the number of fishes or fungi, which have been studied less intensively and for a shorter period of time. About 95 percent of El Salvador's bird species and 90 percent of all its terrestrial vertebrates probably already have been identified (Owen,J., per com, 2009). Species of these groups new to El Salvador, however, are occasionally identified, often because they have immigrated over the border from Honduras, Guatemala, or Nicaragua. The numbers of identified species for the groups that have been less studied, such as most insect groups, some groups of plants, non-fish marine groups, are almost certainly only a small percentage of their total number of species in El Salvador. Almost no studies have been made of the algae, fungi and protista groups. Any estimate of the number of species in these groups is based on educated guesses rather than field studies.<sup>5</sup>

The fourth column of Table 5 no doubt underestimates the number of threatened or endangered species in El Salvador. For a species to be declared as threatened or endangered requires sufficient, reliable field data about the population of that species. Few species have been studied in El Salvador sufficiently so that such data are available. Those species that have been studied sufficiently tend to be the larger, showier, rarer or more commercially valuable species, such as mahogany, marine turtles, parrots, quetzals, and white hawks. More obscure species are unlikely in El Salvador to receive sufficient scientific attention to be declared threatened or endangered.

<sup>5</sup> This is the reason why the National Strategy for Biodiversity identified inventories of groups of organisms as El Salvador's second highest priority for biodiversity conservation.

SalvaNATURA, for example, has been monitoring some bird species in the way that is required to determine reliable trends in their populations. Since 2003, it has monitored the populations within three national parks of over 100 terrestrial bird species and has found that the populations of 30 percent of the migratory bird species and 20 percent of resident bird species have declined over this period. Most of these species, however, have not been listed as endangered or threatened (Komar et al, in press; Komar et al. 2009; Komar, O. pers. com., 2009).

SalvaNATURA has also been monitoring breeding shorebirds in the Xirihualtique-Jiquilisco Biosphere Reserve. The results indicate that the nesting populations of the least tern (*Sternula antillarum*), Wilson's plover (*Charadrius wilsonia*) and collared plover (*Charadrius collaris*) declined by nearly 50 percent between 2008 and 2009 (O. Komar, pers. com, 2009); E. Martinez, unpublished data, 2009) and that black skimmers (*Rynchops niger*) and American oystercatchers (*Haematopus palliatus*) experienced nearly complete nesting failure in both 2008 and 2009. These species have been classified as endangered in El Salvador. Such monitoring data, however, are rare in El Salvador.

Reliable evaluations of the conservation status of individual species and of the effectiveness of conservation measures require that such field data be collected over long periods of time. No possibility exists, however, that the populations of more than a few of El Salvador's species will ever be monitored intensively for long periods. It is more practical, therefore, to rely primarily on the status of habitat as an indicator of the population of a species. Primary forests provide the types of habitat that a large percentage of El Salvador's most highly specialized and inter-dependent organisms require, and it is these species that are likely to become threatened or endangered. The less of this type of habitat remains, therefore, the more likely it is that species of the terrestrial groups of living organisms will be threatened or endangered. For example, at least 250 species of birds, 350 species of butterflies and probably over 400 species of native trees will not be able to survive in El Salvador if sufficient area of their required primary forest habitat is not conserved. Many of these birds, trees, and butterflies are almost certainly already threatened or endangered due to lack of sufficient area of primary forest.<sup>6</sup>

El Salvador's aquatic species also require appropriate habitats in order to survive as species in El Salvador. If aquatic habitats are destroyed or degraded through contamination, introduction of exotic species, or physical changes, then they will not provide the habitats that many aquatic species require for their survival. As for terrestrial species, the study of thousands of individual aquatic species is not feasible, so it is more practical to conserve these species by protecting areas of aquatic habitats.

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<sup>6</sup> Many of the less common tropical organisms have specialized requirements for food, pollinators, seed dispersal agents and micro-habitat that can only be met if the appropriate types and areas of habitats are available to them. They also may require more than one type of habitat in order to complete their cycles of feeding, reproduction and growth. In El Salvador, for example, there are organisms that move between cloud and adjacent oak-pine forests, between mangroves, evergreen coastal forests or freshwater swamps and from higher altitude broadleaf forest to lower altitude or coastal deciduous or evergreen forest. Some organisms, such as the jaguar, tapir, white-lipped peccaries and harpy eagle, as well as some species of trees, also require large extensions of adequate primary habitat. Since such large areas of primary habitat no longer exist in El Salvador it is unlikely that these types of species will ever again have viable populations in El Salvador, although some individuals may occasionally be sighted when they cross the border from Honduras or Guatemala.

### 3. Genetic Biodiversity

Quezada, J. (per com, 2009) notes that lack of knowledge about the genetic diversity of El Salvador's living organisms may prevent it from making the contribution it could to the country's agricultural production and human health. Reductions in the populations of organisms almost certainly reduce the genetic diversity of the species. The reductions that have been observed in the populations of some of El Salvador's plants and animals, therefore, almost certainly indicate that these species' genetic diversity has also been reduced. Reduced genetic diversity decreases a species' ability to adapt to diseases, insects, aggressive exotic species and changes in climate.

Farmers frequently accumulate much practical knowledge about the genetic diversity of the plants they cultivate. Therefore, more is known about the genetic diversity of El Salvador's domestic than its wild plants. Also, the Ministry of Agriculture and Livestock (MAG) has developed and introduced improved varieties of corn, beans and fruit trees. It has not, however, improved genetically most other types of domesticated plants or studied native Salvadorian genotypes of food and medicinal plants. According to Quezada, more knowledge of the genetics of some of these domestic plants would make an important contribution to the competitiveness of Salvadorian agriculture.

Little is known about the genetic diversity of El Salvador's animals. Two studies that have been carried out in El Salvador on animal genetic diversity, however, clearly indicate how important genetic diversity is for the survival of a species with a small population. A study of a small group of spider monkeys demonstrated that in-breeding has greatly reduced the population's genetic variability. Consequently, the population of spider monkeys may not survive (Quezada, pers. com., 2010). Similarly, a study of spiny tailed iguanas indicated higher genetic variability among the larger populations in the eastern highlands than the smaller population in the western highlands (Hasbún, C.R., 2001). The eastern populations, a center of genetic dispersal, thus can probably adapt more quickly to changes in their environment than the western population. Such information about the genetic characteristics of a population of animal species provides important guidance for the selection of protected areas and the location of conservation efforts. There is even less knowledge about the genetic diversity of El Salvador's wild plants. Almost nothing is known about the genetics of even economically important wild plants such as indigo or various species of timber trees. Unlike Costa Rica or Mexico, El Salvador has made no genetic studies of its medicinal plants.<sup>7</sup> It also has no process for giving permission for bio-prospecting, which is a severe constraint on obtaining funds for research on the genetic properties of traditional medicinal plants (Quezada, per com, 2009).

## B. EL SALVADOR'S FORESTS

### 1. Forest Types and Areas

Table 6 gives three estimates of El Salvador's forest area according to classifications of its forest types.

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<sup>7</sup> Researchers in the medical school of the University of San Salvador are studying the chemical and proteins of some medicinal plants, in hopes of developing new medicines.

**Table 6 Forest types and areas in El Salvador**

FAO, 2006		MARN, 2000		Hecht, S. & S. Saatchi 2005	
Type	Area (ha)	Type	Area (ha)	Type	Area (ha)
Secondary	61,992	Brush	77,800	Secondary	1,030,000
Chaparral	367			Remnant	40,000
Alluvial	7,735			Protected Areas	25,000
Deciduous	10,330				
Gallery	6,186			Domestic	100,000
Mangrove	41,512	Mangrove	35,000	Mangrove	25,000
Pine	76,470	Conifer	48,500	Orchards & coco	35,000
Oak and other	13,091	Broadleaf	90,000		
Cloud	2,442				
Sub-Deciduous	37,674				
Tree Plantations	6,585	Tree Plantations	5,800	Tree Plantations	5,000
<b>TOTAL</b>	<b>264,322</b>		<b>257,100</b>		<b>1,260,000</b>
Shaded Coffee	160,944	Shaded Coffee	195,000	Shaded Coffee	170,000
<b>TOTAL</b>	<b>425,266</b>		<b>452,100</b>		<b>1,430,000</b>

The FAO estimate of El Salvador's forest area is 425,266 ha. The MARN estimate is slightly less 452,100 ha. The MAG estimate for El Salvador's forest area, shown in Table 5, is 337,200 ha. Fuentes (2006) estimated a forest area of 554,400 ha, as shown in Table 7. By contrast, Hecht and Saatchi estimated El Salvador's forest area to be 1,430,000 ha. The discrepancy between these estimates probably reflects different definitions of forested land, especially of secondary forest. Hecht and Saatchi (2005) say that "...secondary forests of various ages and forms... cover at least half of El Salvador.." Half of terrestrial El Salvador would be 1,030,000 ha. The FAO estimate of El Salvador's secondary forest, by contrast, was only 61,992 ha. The MARN estimates do not have a classification for secondary forest. The MAG and Fuentes estimates did not subdivide the forest by types.

Hecht and Saatchi (2005) analyzed changes in El Salvador's forest cover between the 1980s and the early 2000s. They found that during this period El Salvador's area of low density forest cover increased by 22 percent. The largest increase occurred in the northern departments, in mountainous zones at the edge of agricultural frontiers and in regions that had been under the control of the Farabundo Marti Front for National Liberation (MFNL). Subsequent research by Saatchi indicates that El Salvador's area of secondary forest has continued to increase through the 2000's. (Hecht, per. com., 2009). Hecht and Saatchi attribute this increase in the area of secondary forest to (1) the prevalence of insecurity in rural areas; (2) low prices for basic grains and high prices of agricultural chemicals; (3) reduced government subsidies for agricultural production and other rural investments; (4) democratization and decentralization; (5) an inflow of remittances to rural areas from Salvadorian migrants in the United States; and (6) an international environmental ideology that favors environmental rather than agricultural investments in rural areas.

Most deforestation, by contrast, was occurring on the edges of San Salvador and other cities and in the coastal zone. Chemonics (2010) cites an FAO estimate that between 4,000 and 7,000 ha of deforestation occur per year in El Salvador.

## 2. Forest Geographic Location

The geographic location of El Salvador's forest area provides another indicator of the status of its forest. Table 7 shows the results of a study made in 2006 of forest cover by department based on satellite imagery (Fuentes, 2006).

**Table 7 Forest cover by department in El Salvador, 2006**

Department & Percent Forest Cover	Area of Department (Km <sup>2</sup> )		Percent Forest Cover in Department	Geographic Location
<b>Greater than 30 %</b>				
Morazan	1,459	682	47	Northeast Mountains
Ahuachapan	1,179	415	35	Southwest Mountains
Santa Ana	1,966	763	39	Northwest Mountains
Sonsonate	1,218	410	34	Southwest Mountains
La Libertad	1,652	539	33	Southwest Mountains
<b>20 to 29 %</b>				
Usulután	1,971	579	29	Central Valley
San Salvador	859	238	28	Volcanic chain
Cuscatlán	684	193	28	Eastern Valley
La Paz	1,179	309	26	Central Coastal Plain
San Miguel	2,078	436	21	Eastern Valley
<b>Less than 20 %</b>				
Chalatenango	1,959	364	19	Northern Valley
La Unión	2,065	371	18	Eastern Valley
San Vicente	1,172	130	11	Central Valley
Cabanas	1,084	123	11	Central Valley
<b>Total</b>	<b>20,527</b>	<b>5,544</b>	<b>27</b>	

Source: Fuentes, 2009

Table 7 indicates that the Department of Morazan, in the northeast mountains along the Honduras border, has the highest percentage of forest cover (47 percent). The departments with the next highest percentages of forest cover are Santa Ana, Ahuachapan, Sonsonate and La Libertad. Forests cover between 20 and 30 percent of the Departments of Cuscatlán, La Paz, San Miguel, San Salvador, and Usulután. The departments with less than 20 percent

forest cover are Cabanas, San Vicente, La Union, and Chalatenango. These data indicate that percentage of forest cover is higher in the departments with extensive coffee plantations, since coffee plantations with shade trees are classified as forests, in the more mountainous departments.

### **3. Forest Quality**

The quality of the different types of Salvador's forests can be evaluated by the extent of the benefits they are able to provide to humans. Forests provide three broad categories of benefits: (1) the diversity of ecosystems, species, and genes that together compose biodiversity; (2) forest products; and (3) ecosystem functions and services. Based on Hecht's and Saachi's classification of El Salvador's forests, the following sections discuss the degree to which El Salvador's different types of forests provide these benefits.

#### **Secondary Forest**

Secondary forest includes many different types of forest, but as a category it includes by far the greatest parts of El Salvador's forest. The biodiversity values of a secondary forest vary with its age, structure, species composition, size, and proximity to areas of primary forest. Rarer organisms generally utilize more mature forest habitat and the larger of them often require extensive contiguous areas of forest. Younger, smaller areas of secondary forest far from non-secondary forest, therefore, are usually less valuable for biodiversity conservation than older, larger areas of secondary forest nearer to non-secondary forest. El Salvador, as discussed previously, has only a few, small areas of climax forest left, most of them within national protected natural areas. Areas of its secondary forest that occur adjacent to these protected natural areas, therefore, are especially valuable for biodiversity conservation since if they are allowed to grow long enough without disturbance they may eventually develop the type of habitat required by some of El Salvador's rarer, threatened and endangered organisms and would increase the total contiguous area of primary forest habitat.

The value of secondary forest for products, such as firewood, poles and lumber, depends on such variables as their species of tree, bushes and herbs, location, site quality, and accessibility. Little is known about these variables in relation to El Salvador's secondary forest. Quite frequently, however, the species found in secondary forests produce commercially valuable wood products. Secondary forests also tend to have fewer species of trees per unit of area, which facilitates the management of the stand and the harvesting of its timber products. Furthermore, a portion of El Salvador's secondary forest has regenerated on former farmland. These sites may be accessible and have soils on which trees will grow rapidly, and thus be economically valuable for wood production.

All forests and trees perform some ecosystem functions and provide ecosystem services. Nonetheless, secondary forests located on steep, mountain slopes generally would have more value for regulating water flow than those located in valley bottoms. Also, forests dominated by some species of trees create more fertile soils than forests dominated by other species of trees. Species of trees which fix nitrogen, for example, tend to create particularly fertile soils.

#### **Remnant and Protected Forest**

El Salvador's small remaining areas of remnant and protected forest contain its only climax, or primary, forest (Dangherty, 1969). As previously discussed, these areas have enormous value for the conservation of biodiversity because they provide the habitat that most of El Salvador's rarer, threatened and endangered terrestrial organisms require to survive as species in the country. Remnant and protected forests are no longer important for forest products because their total area is very small and what timber trees they may have once had have almost all

been exploited. In any case, it is now illegal to exploit forests within the protected areas where most of the remnant and protected forest occurs. Although their small total area reduces the value of remnant and protected forests for ecosystem functions, remnant and protected forests are frequently located in the upper parts of El Salvador's watersheds, which amplifies their value for this purpose.

### **Domestic forests: Orchards, Coco and Shaded Coffee Forests**

Domestic forests yield the commercially valuable products for which they were established. Coffee beans, for example, have been a valuable Salvadoran crop for over 150 years. This type of forest also provides most of El Salvador's fuel wood, which in rural areas is still used extensively for cooking.

Hetch and Saatchi (2005) note that this type of forest is "...more biodiverse than was previously thought because they buffer declines in regional diversity and are extensively used by old-growth species." Nonetheless, although some rare species of birds and animals may occasionally be seen in this type of habitat, most of El Salvador's rarer species could not survive as a species in the country if only this type of forest habitat were available to them.

Many people receive direct benefits from the ecosystem services from this forest type, because it occurs in more densely populated areas of El Salvador. These forests moderate flooding, shade buildings, and increase the attractiveness of the landscape. Currently, for example, the coffee plantations on the mountains that surround San Salvador increase the attractiveness of the city and help to protect it from flooding and landslides.

### **Tree Plantations**

Although tree plantations may be valuable locally, they make only a minor contribution to the Salvadorian economy as a whole, because their total area is so small. Also, field observations suggest that many of the teak plantations which were planted two decades or so ago, some of which were financed by USAID, may have already been exploited. Since their coppices have received no silvicultural treatments, these teak plantations will be unlikely to produce a second harvest of commercially valuable wood. No information was available about the area or quality of recent tree plantations, although field observations did indicate that some teak plantations have been recently planted in the Central Zone.

Many tree plantations are planted with exotic species, such as eucalyptus, pine, and teak. These species generally do not create habitat that is generally used by El Salvador's rarer, threatened and endangered species of plants and animals. Tree plantations of some exotic species, however, can improve site conditions, by restoring soil fertility and structure, and thus create conditions which will permit native plants to regenerate.

El Salvador's area of plantations is too small to be important for the provision of ecosystem services on a large scale. Locally, however, tree plantations may protect small watersheds that supply water for local use or may stabilize slopes, thus reducing the risk from landslides. If tree plantations were to be established over extensive areas they could protect watersheds on a larger scale, improve the landscapes visual attractiveness and moderate local climate. Tree plantations, however, rarely can be economically justified only for ecosystem services, especially when, as in El Salvador, natural regeneration of secondary forest will generally occur on any site that has the minimum required conditions of soil and sources of seed.

### **Mangrove Forest**

Mangrove forests provide some valuable ecosystem services, such as protecting shorelines from erosion and providing food and shelter to estuarine and marine organisms. Some of the tree species that make up the mangrove forest grow fast and produce good fuel wood and straight poles that resist decay, making them excellent for construction on poorly drained sites. Mangrove forest can also sometimes be an attractive destination for tourists. Mangrove forests have relatively few plant species. They do, however, provide habitat for many species of invertebrates, birds and fish, some with considerable commercial value, during all or part of their life cycles. During the 1960's and 1970's many shrimp ponds were constructed in El Salvador and part of them occupied areas of mangrove forest (Guevara J. et al, 1983). The mangrove forests that surround shrimp ponds make an important contribution to the shrimp production.

## **IV. THREATS TO EL SALVADOR'S BIODIVERSITY AND FORESTS<sup>8</sup>**

### **A. DIRECT THREATS**

#### **1. Habitat Loss, Fragmentation and Degradation**

The small total area of El Salvador's primary forest is the principal direct threat to El Salvador's biodiversity and tropical forests. There are less than 21,000 ha of primary forest left in El Salvador. Even if 21,000 ha of primary forest occurred in one block, the area would be too small for some species of plants and animals that inhabited El Salvador less than a century ago to survive. The jaguar, the tapir, the ornate hawk eagle, the jabiru and the scarlet macaw, for example, still inhabited El Salvador during the early twentieth century (Dickey and Van Rossem, 1938; Serrano, 1978). The first two, however, require at least 100,000 contiguous hectares of primary forest to sustain a population that has sufficient genetic variability to survive. The other three species probably require at least 30,000 ha. El Salvador, therefore, has no possibility of recovering viable populations of the species that require such large, continuous areas of primary forest.

In fact, El Salvador's remaining areas of primary forest are located in even smaller blocks. Within El Salvador, inside and adjacent to the Montecristo National Park, there are only about 2,500 ha of primary forest. Adjoining primary forest in Honduras and Guatemala adds about 3,500 ha to a contiguous block of primary forest. Even so, the total contiguous area of primary forest is only 6,000 ha. Contiguous primary forest within and adjacent to El Imposible National Park totals only about 2,500 ha. All of El Salvador's other blocks of primary forest are even smaller.

The populations of less rare plants and animals may be declining in El Salvador for lack of sufficient area of primary forest. The populations of king vulture, margay cat, black hawk eagle and white hawk, for example, are all very small, probably because there is so little left of the primary forest habitat which they require. Bird inventories indicate that the populations in the

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<sup>8</sup> A direct threat to biodiversity or tropical forests is the action or force that affects them. An indirect threat to biodiversity is the condition, circumstance or situation that is the cause of the direct threat. It is important to not confuse threats to biodiversity and tropical forests with the actions that are required to conserve biodiversity and tropical forests. Section V of this report identifies ten categories of actions that are required in El Salvador to conserve its biodiversity and tropical forests. The lack of these actions, however, is not a direct or indirect threat to El Salvador's biodiversity or tropical forests. Ineffective conservation institutions, misguided policies, or lack of conservation research, for example, are not threats to El Salvador's biodiversity and tropical forests. They are lack of effective responses to the direct and indirect threats.

Montecristo National Park of medium to small birds have been declining (Komar, per. com., 2009). It is not only are the populations of animal species that are declining. About 40 percent of Salvadorian trees are probably in danger of extinction because they have lost not only their habitat but also their pollinators, seed dispersers and other important symbiotic agents (Reina, M.L., per. com., 2009).

A further reduction in the area of primary forest in El Salvador thus would greatly increase the threat to the survival in the country of many species of plants and animals. These species include not only most of the country's largest and showiest animals, but also predators whose presence is vital for maintaining ecological balances in primary forest ecosystems. This report could not evaluate the degree to which specific areas of primary forest in El Salvador are threatened. Barborak (no date), however, says that one of the threats to the El Imposible and Barra de Santiago protected areas is the presence of farmers who, if the circumstances warrant and permit, may convert part of the primary forest to agricultural and pasture land. It is reasonable to suppose that other protected areas are under a similar threat.

Primary forest habitat, however, is not the only type of habitat in El Salvador whose loss or degradation threatens the biodiversity. The original, very low growth vegetation of El Salvador's beaches, for example, provide suitable habitat for the nesting sites of marine turtles, other coastal reptiles, crustaceans and many shore birds, but construction has modified almost all of this habitat. Changes in fresh water lakes and rivers will affect the habitat they provide to fresh water species of fish and other groups of organisms. Data were not available for this report to enable it to evaluate the scale and intensity of the threat from habitat loss, fragmentation and degradation for all of these habitats in El Salvador. Nonetheless, these threats clearly indicate that to conserve its biodiversity, El Salvador needs to ensure that its national system of protected natural areas serves the purpose for which it was established, that of conserving habitat for its rare, threatened and endangered species.

## **2. Over-exploitation**

Over-exploitation threatens Salvadorian ecosystem, species and genetic diversity mostly because of commercial extraction of valuable species. High commercial value stimulates exploitation at a level that eventually reduces the population of the species to levels that are too low to maintain a commercially viable exploitation. Since rare species often only occur within climax forest habitats, their over-exploitation often occurs within or adjacent to El Salvador's protected areas where such habitat still occurs, especially the El Imposible and Montecristo National Parks. Examples of such species include the *paca* and the *curassow*, both of which require the intact habitat of the El Imposible National Park in order reproduce successfully.

Over-exploitation is less likely to affect the viability of El Salvador's more common species because they generally utilize widespread types of habitat to complete their life cycles. In some cases, however, over-exploitation has affected the species populations of common species and species that are caught together with them. The trawling techniques used to catch marine white shrimp off El Salvador's coast, for example, have not only over-exploited the stocks of the white shrimp itself but have destroyed extensive areas of sea floor habitat and have killed large numbers of dolphins and sea turtles (CENDEPESCA, 2009). Similarly, it is common in El Salvador's rivers and estuaries for the poisons and dynamite used to catch shrimp, fish and crabs to also destroy large numbers of non-commercial, sometimes rarer, aquatic species.

Over-exploitation of marine sea turtle eggs is a particular threat to the four species of marine turtles that lay their eggs on El Salvador's beaches. Although the marine turtles lay their eggs in

large quantities, their eggs have a high commercial value and their collection and sale provide work for numerous people. The exploitation of their eggs, therefore, can threaten the population numbers of the marine turtles (see Success Story No 2).

### **3. Contamination**

Contamination in El Salvador probably mostly affects its freshwater biodiversity. The main source of contamination is urban waste water that is discharged without treatment into bodies of fresh water. No specific study of the effect of water contamination on biodiversity was located for this study. In 2007, however, the National Diagnosis of the Quality of Superficial Water sampled water quality in 114 sites in all of El Salvador's ten watersheds. Water at 60 percent of the sites was "bad", at 15 percent was "regular, and at 25 percent was "very bad". The water at none of the sites were rated as "excellent" or "good" (Esquivel, O., 2007). Such high levels of water contamination must be affecting El Salvador's fresh water aquatic biodiversity. Carried by rivers, contamination also reaches the coastal estuaries, affecting their biodiversity. Contamination probably affects El Salvador's marine biodiversity near to the outlets of its larger rivers.

Agricultural chemicals also contaminate El Salvador's aquatic ecosystems. Herbicides, fungicides and insecticides are used frequently on El Salvador's major crop, coffee, in order to control insects, diseases and weeds (Soler, R., 2009, per com). Although until the 1990's, El Salvador was notorious for heavy applications of pesticides on its cotton crops on the coastal plain, El Salvador now grows little cotton, so this threat to El Salvador's biodiversity has almost disappeared. Fertilizers may sometimes increase the nutrients in water bodies, causing eutrophication. However, no specific studies of such threats from chemical contamination of water to El Salvador's aquatic biodiversity were located for this report.

### **4. Aggressive exotic species**

IUCN's Invasive Species Specialist Group notes how aggressive introduced species can out-compete or otherwise harm native species (IUCN-ISSG, 2009). A number of such aggressive invasive species of plants, vertebrates and invertebrates have been identified and described in El Salvador (Ventura, N. 2002; Vásquez, M. 2002, González, M., 2002). Although it has been surmised that these invasive species are adversely affecting native species and ecosystems, no quantitative data could be located for use in this report regarding the character, extent, intensity or location of their adverse effects on biodiversity. Some examples of such species and their effects on biodiversity, however, have been described qualitatively. In the 1960's, for example, exotic species of wasps were introduced into El Salvador for the control of a broad spectrum of agricultural pests. At least one species of wasp has become a widespread, aggressive parasitoid on a broad spectrum of butterflies and is now impossible to control.

Of particular concern for conservation in El Salvador would be aggressive species that enter protected natural areas and adversely affect their native organisms, especially those that are already rare, threatened or endangered. No specific study on this threat to the ecosystem, species and genetic biodiversity in El Salvador's protected areas, however, was located for use in this report. Domestic animals, including dogs, chickens, horses, cattle, and cats, have adversely affected the biodiversity contained within many of El Salvador's protected areas. They compete for food and introduce diseases and parasites that affect wild animals. In 1995, for example, a weak adult male great curassow that was captured near to the El Imposible National Park was found to be infested with eight different species of parasites that normally occur on domestic animals (Herrera. S. and A.E. Vásquez, 1995). The diseases and parasites

introduced by domestic animals are likely particularly to threaten the larger predators, such as the spotted cats.

The introduction of an exotic fish, the tiger cichlid, from Nicaragua for commercial production has caused a decrease in the population or demise of several species of native freshwater fish (Orellana, J. J., unpublished), clearly indicating the dangers to aquatic biodiversity of using natural bodies of water, such as lakes and rivers, to grow fish commercially. The water hyacinth, now distributed throughout El Salvador's larger freshwater water bodies, depletes the aquatic ecosystems of light and oxygen, undoubtedly adversely affecting the life cycles of native aquatic species.

## **5. Climate Change**

A permanent warming of the global climate would almost certainly affect El Salvador's ecosystem, species and genetic biodiversity, although it is difficult to predict the potential scope or intensity of such potential changes. Studies in Costa Rica, however, have indicated that a warming trend in the climate may have caused declines or displacements of several groups of native vertebrates which live in its highlands. Hummingbirds, for example, have migrated to higher elevations and their populations have decreased (Fogden, M. and P. Fogden, 2006). Studies in Costa Rica of the populations of ants, geometrid moths, understory plants and epiphytes have shown similar trends. Costa Rica's mangrove habitats are also thought to have a high risk of contracting in area as a result of a warming climate (INBIO, 2009).

Extrapolating from Costa Rica, a warming trend in the global climate would be most likely to affect coastal ecosystems and highland vegetation formations. Some of the threatened and endangered species that utilize these habitats may not be able adjust to rapid change caused by a warming trend. Coastal species, for example, might not move inland quickly enough in response to a rapid rise in sea level and species which already inhabit the tops of mountains would not be able to move any higher as a means of adjusting to a warmer climate.

## **B. INDIRECT THREATS**

### **1. Legal Situation of Protected Areas**

Two aspects of the legal situation of El Salvador's protected areas create a severe indirect threat to their biodiversity and forests. First, only 52 of the areas that were set aside to become protected areas as part of the 1982 land reform process have been legally transferred to MARN and become legally established protected areas. Their uncertain legal status has made many of these areas more susceptible to uncontrolled invasion by rural people, usually leading to the destruction of their vegetation.<sup>9</sup>

Second, the conservation objective of the protected areas sometimes is at risk of being subordinated to the social objective of satisfying demands of rural people for land, access to natural resources, and increased incomes. There is no question that the 2005 Law of Protected Natural Areas intended to establish a single, clear objective for protected areas of conserving biodiversity, including forest habitat.<sup>10</sup> Yet it is sometimes difficult for decision makers to

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<sup>9</sup> The President of the Institute for Agrarian Transformation (ISTA) stressed to the authors of this report that one of her principal objectives is to complete the transfer to MARN of these protected areas.

<sup>10</sup> The 2005 Law of Natural Protected Areas 2005 makes clear that the main objective of protected areas is "to preserve the natural state of the biological communities" and Article 6, Literal O states that MARN must "...guarantee the conservation of the biodiversity.." within these protected areas and defines national parks as areas that must "be managed mainly for the conservation of ecosystems..." Furthermore, Article 29 states that "...in natural protected areas...no growth of existing (human) or establishment

reconcile that priority with the demands of the rural people living in and around the protected areas for access to land and other natural resources from which they can earn a living, however marginal. In early 2010, the MARN announced a new policy of promoting management of one of El Salvador's most important protected areas, the Montecristo National Park, "...by the internal human communities so as to make them direct beneficiaries of this management" (Diario de Hoy, 6 Jan 2010). Such a policy does not clearly define that the main objective of a national park such as Montecristo is the conservation of biodiversity through the attainment of clear biodiversity objectives, not benefits for people who live in and around the park. It is possible, therefore, that the policies of the MARN itself have become one of the indirect threats to the biodiversity within this and, by extension, other national protected areas.

## **2. Population Growth and Migrations**

El Salvador's high population density has been and continues to be an indirect threat to its forests and biodiversity. Forty-two percent of El Salvador's population, or about 2.4 million people, still live in rural areas. Most of these rural people depend wholly or partially on natural resources to earn their living. In particular, rural Salvadorians have a long tradition of clearing and burning forest in order to clear land for agricultural land and pasture. Few of them perceive El Salvador's forest areas as a habitat that is valuable, indeed required, for the conservation of rare, threatened and endangered species.

As previously noted, recently the area of secondary forest in El Salvador has been expanding. Yet shifting agriculture has never completely stopped. If one or more of the circumstance that Hecht and Saachi (2005) describe as driving the abandonment of agricultural land and pastures were to slow down or reverse, then it is possible that some rural Salvadorians would increase their rate of conversion of forest areas to pasture and agriculture. The conversion of even a relatively small area of primary forest could cause severe adverse consequences for some of El Salvador's threatened and endangered species. The conversion of secondary forest areas back to agriculture and pasture would not be so likely to cause adverse effects on biodiversity. Yet even so, it would reduce the area of habitat for many species of plants and animals and in some place reduce the possibility for secondary forest developing into primary forest.

By comparison, urban expansion not only is likely to cause extensive deforestation but will be unlikely to affect primary forests, which rarely occur around El Salvador's cities and towns. Deforestation near to urban areas may in some places increase the risks from flooding and landslides, but it is unlikely to affect El Salvador's biodiversity severely.

## **3. Inequitable Distribution of Land**

Inequitable distribution of land in El Salvador was long a major indirect threat to its forests and biodiversity. According to Daugherty (1969) during the twentieth century "The persistence of a feudal-like landholding system...forced a growing number of subsistence farmers onto sloped land not ecologically suitable for large numbers of shifting cultivators. The result was to accelerate the alteration...of the ecologic base of El Salvador". Browning (1975) describes how the concentration of land took place between 1875 and 1975. The land reform that started in 1982, however, subdivided most large rural properties and distributed the resulting parcels among several hundred thousand rural Salvadorians, thus greatly reducing inequitable distribution of land as an indirect threat to El Salvador's biodiversity and forests.

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of new infrastructure will be allowed." The law even states that if the government is permitted to resettle people living inside protected areas if their activities conflict with its conservation objectives.

Even as early as 1993, however, Mitchell Seligson, in a report to USAID, concluded that rural and urban industrialization would be a more practical way to improve rural incomes than redistribution of land. In 2000, a World Bank report reached a similar conclusion, recommending a strategy of improving El Salvador's rural economy by increasing and improving rural education, infrastructure, technology, and off-farm employment. This was in fact the policy for rural development adopted by the ARENA governments that held power in El Salvador from 1992 to 2009. By 2010 agriculture and livestock no longer were the principal sources of income for most Salvadorians, as they were several decades ago, another reason why inequitable distribution of land is no longer a severe indirect threat to El Salvador's biodiversity and forests.

#### **4. Economic Policies and Globalization**

Economic policies have long been an indirect threat to El Salvador's biodiversity and forests. The Spanish introduced commercial export agriculture and ranching into El Salvador. Both land uses required the extensive use of fire to clear forests, drastically reducing the area of suitable habitat for organisms that require specialized ecological niches in order to maintain their populations (Daugherty, H., 1969). As early as 1800, the demand for wood from mines had caused over-exploitation of the forests of central Morazan and northern Santa Ana. During the nineteenth century forest over-exploitation to supply mines with fuel made the northern portions of San Miguel, Morazan and La Union a "barren and scrub covered area" (Macom, et al, 1898, in Daugherty, 1969), a habitat in which many organisms could no longer survive as species.

In the second half of the 19th century, coffee became El Salvador's principal agricultural export crop. Coffee plantations replaced almost all the central and southern oak-pine forests between 1,000 and 1,700 meters above sea level. The coffee plantations created a relatively uniform habitat, with an understory of coffee and an overstory of a few, common tree species. The international market for export crops, such as sugar and cotton that grew well on the fertile, hot coastal plain drove its deforestation. By 1900 most of its evergreen forest had been cleared, eliminating the habitat for many of El Salvador's least common animals and plants. Daugherty (1969) notes that "...during the twentieth century the area of El Salvador devoted to non-food cash crops (coffee, cotton and sugar cane) was greater than the area devoted to food staples, such as beans and rice, a reflection of the same cash crop orientation of the landed class as that of the original Spanish conquistadors." International trade in some species of macaws and parrots until a few years ago may have contributed to their over-exploitation and local extinction. International demand for sea cucumbers has recently devastated their populations along most of El Salvador's coast (Barrera, E., per. com. 2009).

Overall globalization and El Salvador's economic policies during the 1990's and early 2000's, have probably benefited El Salvador's terrestrial biodiversity and forests. Hecht, S. and S. Saatchi (2005) analyze how El Salvador's economic policies that reduced subsidies for agriculture and incorporated El Salvador into the global economy have contributed to an expansion of secondary forest in El Salvador. Secondary forest provides habitat for many, although mostly more common, species of plants and animals. As discussed previously, if secondary forests located adjacent to existing primary forests, were to develop into primary forests they could provide an increased area of habitat for El Salvador's rarer species (Harvey, C., et al, 2007). By the same token, however, a reversion of economic policies to favor subsidies for domestic agriculture and livestock and protection for domestic production could reverse the expansion of secondary forest and become an indirect threat to El Salvador's biodiversity and forests.

## 5. Corruption

Corruption involving the Institute for Agrarian Reform (ISTA) has been an indirect threat to El Salvador's biodiversity and tropical forests. Corruption has been one of the reasons that only 53 of the areas which were set aside under the land reform of 1982 to become protected areas have so far been transferred to MARN and become official, legal protected areas. While under the control of ISTA, moreover, many of these areas have been illegally sold, invaded and deforested.<sup>11</sup>

El Salvador's current government has indicated that it intends to end corruption in ISTA. In October 2009, the new president of ISTA announced that she had requested an official investigation through the office of the Attorney General into ISTA's transactions related to the protected area lands (La Prensa Grafica, 2009). ISTA still has to prove itself free of corruption, however, and until it does so, this indirect threat of corruption to El Salvador's biodiversity and tropical forests remains.

## 6. Conflict

Ing. Herman Rosa, the current Salvadorian Minister of Environment and Natural Resources, believes that conflict over the rights to and uses of natural resources is a principal current indirect threat to El Salvador's environment and economic growth. On the one hand, conflicts over rights to the use of land, water and other natural resources impede conservation actions. On the other hand, such conflicts complicate and reduce investment, slowing economic growth and the creation of wealth (Rosa, H., per. com., 2009). If rural people stay poor, and do not have other attractive alternatives, then they are less likely to conserve biodiversity and forests and more likely to change land use from forest to agriculture and pasture. Ing. Rosa stressed his belief that conflict over natural resources undercuts the growth of El Salvador's economy by creating uncertainty among investors and by leading to poor investment decisions. The resolution of the conflicts over access to land and natural resources thus could contribute to the conservation of biodiversity and forests by improving the economy and providing better paid work for rural people. If the conflicts are resolved by ceding to rural demands for access to protected areas, however, protected areas could lose the ability to achieve their conservation objectives. Ing. Rosa provided the policy statement shown in Table 25 as the policy position of the MARN.

Minister Rosa, moreover, points out that conflict over access to natural resources is undercutting El Salvador's economic growth. Only strong economic growth can provide El Salvador with sufficient financial resources of its own to finance actions to conserve its forests and biodiversity adequately over the long-term. A poor El Salvador will not be able to finance the conservation actions that are required to conserve its biodiversity and forests. Economic growth and conservation of biodiversity and forests can thus be mutually beneficial.

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<sup>11</sup> After 1992 the land reform process not only slowed down but became mired in corruption. One thousand families of ex-soldiers, for example, were given land within the Nancuchiname protected area, one of El Salvador's most valuable protected natural areas and its buffer zone. Consequently, the cutting of trees for use in building houses and burning of the forest to create agricultural land and pasture became rampant. Similar gifts of protected areas to ex-soldiers were made of in the Santa Clara protected natural area. Protests in the press were of no avail in stopping these illegal and corrupt conveyances of national protected natural areas to private ownership. The government of President Flores requested an official report from ISTA on its handling of the transfer of designated national protected areas to MARN. Instead, ISTA's president and board of directors resigned and new ones appointed. In 2001, press reports accused the new ISTA president of corruption in relation to the transfer of the protected areas. He publically admitted that he had arranged the transfer of protected areas to members of his political party (El Faro, 2004). It also became public knowledge that ISTA was selling public land on the island of San Sebastian, a national protected natural area.

## Box 2. Policy Statement of the El Salvador's Minister of Environment and Natural Resources

Dear Dr. Serrano:

Under MARN's current vision, one of the priority areas is to advance territorial governance. This implies addressing the growing conflicts for natural resources and exploring options to conserve and restore ecosystems incorporating local actors. In the case of the National System of Protected Areas, this implies a new management model which contemplates the full integration of the Protected Areas in the local and regional management scheme, avoiding an isolated and individualistic approach. This is in agreement with the Work Program of Protected Areas of the Convention of Biological Diversity which, among other things, establishes that by 2015 all protected areas will be integrated into broader terrestrial and marine landscapes with the objective of maintaining ecological structure and functions, involving pertinent economic and social sectors, applying the ecosystem approach and taking into account ecological connectivity and the concept of ecological webs.

Among the most relevant activities to be developed between 2010-2014 are the following:

Analyze the gaps and identify the priority areas for the conservation of biodiversity that allow for the protection of zones that are highly threatened or of great value.

Restore ecosystems in zones of influence of protected areas and relevant ecosystems. Promote ecological corridors that restore connectivity, guarantee ecological stability of ecosystems and allow for adaptation to climatic change. Priority attention will be given to mangroves.

Local environmental governance in the management of biodiversity. Local communities will be integrated in the management of Protected Areas to make effective the local capacities in conservation and sustainable use of the resources and offer of services. Innovative models of participatory management of resources will be implemented by community organizations and established in social networks. The National Strategy for the Participation of Society in the Management of Protected Natural Areas will be revised, in order to guarantee full and effective participation.

Integration of Biodiversity in the Policies of other sectors, especially in agriculture, fisheries, tourism, as well as territorial planning.

A Strategic Plan for Biodiversity and Climatic Change will be developed. It will include research and knowledge of the impact of climatic change on the structure and functioning of ecosystems and will seek strategies for mitigation and adaptation to climate change. Of particular interest is the attention to invasive exotic species with potential for causing irreversible damage to ecosystems and negative impacts at the social and economic level.

3<sup>rd</sup> of February, 2010

Herman Rosa Chávez  
Minister of the Environment and Natural Resources  
Government of El Salvador

## 7. Infrastructure projects

Infrastructure projects can be an indirect threat to El Salvador's biodiversity and forests because they often cause changes in land use. Changes in land use can destroy or degrade the forest habitat that threatened and endangered species of organisms require. Large road improvement or construction projects in rural areas, for example, often reduce the cost of access to the more remote areas where natural habitat is likely to still exist. People therefore have more incentive to convert forestland to other uses. The project financed by the MCC, which consists of improving and building a road across the Northern Mountains Zone, until now the least accessible part of El Salvador, may be causing indirect negative impacts on forests and biodiversity.<sup>12</sup> Other infrastructure projects in El Salvador, such as dams, ports, tourism facilities, bridges, pipelines, and water supply projects, could also cause direct and indirect negative impacts on biodiversity, forests, and protected areas.

## 8. Property Rights

There are indications that the lack of secure property rights to land and open access to forests could be an indirect threat to forests and biodiversity in El Salvador. Gammadge, S. et al (2002), for example, say that the conservation of El Salvador's mangrove forests requires a "...redefinition of entitlement rights...that take into account the needs of those whose livelihoods are intimately connected to the health of the ecosystem." They also say that "...the present system of laws and regulations that governs resource use in the mangroves is contradictory and confusing." Serrano and Villacorta (2008) say that "...another cause of the lack of firewood is the total protection now given to trees and bushes on land that is heavily fenced and carefully guarded. It is clear that the era of open access to large areas of land is over..." The deteriorated condition of the protected areas that have never been legally transferred to MARN also suggests that property rights strongly influence the conservation of forests and biodiversity. It was beyond the scope of this report to investigate in any further detail how the regime of property rights and rights to access of natural resources is affecting the conservation of biodiversity and forests in El Salvador. Lack of secure property rights, however, should undoubtedly be considered a serious indirect threat to El Salvador's biodiversity and tropical forests.

# V. ACTIONS NEEDED TO CONSERVE EL SALVADOR'S BIODIVERSITY AND TROPICAL FORESTS

Section V discusses the four types of actions which USAID/El Salvador could take or finance in order to assist El Salvador to conserve its biodiversity and tropical forests.

- Part A discusses coordination of conservation actions within USAID/El Salvador itself and between USAID/El Salvador, the Government of El Salvador and other institutions.
- Part B discusses environmental assessments in relation to USAID/El Salvador's proposed strategy for 2010 to 2014 and in relation to El Salvador's environmental assessment process.

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<sup>12</sup> The environmental assessment for the MCA project did not consider the potential indirect negative impacts of the road project on forests and biodiversity (FOMILENIO. 2006).

- Part C discusses the design and implementation of conservation actions.
- Part D discusses the ten categories of conservation actions that are needed in El Salvador in order to conserve its biodiversity and forests.

## **A. COORDINATION OF CONSERVATION ACTIVITIES**

Coordination reduces duplication, reinforces conservation initiatives, stimulates the sharing of successful experiences and creates a stronger momentum for conservation. Thus USAID/El Salvador can assist El Salvador to conserve its biodiversity and tropical forests by coordinating its conservation actions with the Government of El Salvador, with the other activities it finances, with the activities of other U.S. Government agencies in El Salvador, and with other international donors.

### **1. Coordinating with the Government of El Salvador**

Conservation of biodiversity and tropical forests requires permanent, not temporary, actions. USAID/El Salvador's assistance to El Salvador is, of course, temporary, while the Government of El Salvador has a permanent responsibility for the long-term, continuous conservation of the country's biodiversity and forests. To produce long-term conservation results in El Salvador, therefore, USAID/El Salvador should coordinate closely all of the conservation activities it finances with the appropriate institutions that form part of the Government of El Salvador. By working with the Government of El Salvador, especially MARN and MAG, USAID/El Salvador can not only assist it to formulate and implement an effective strategy for biodiversity and forest conservation but can place the conservation programs that it finances within the context of Salvadorian long-term, permanent conservation actions.

### **2. Coordinating USAID/El Salvador Strategic Objectives**

The following sections indicate how conservation activities and USAID/El Salvador's strategic objectives can be mutually supportive.

#### **Investing in People**

Conservation of biodiversity and forest provides an example of how integrated teaching prepares students for resolving complex current problems. To be effective, conservation programs must use an integrated, multidisciplinary approach, involving scientific and social science disciplines. The conservation of the Montecristo National Park, for example, requires the integration of social, economic, biological and even historical knowledge. Teachers who have studied the example of a protected area would come to understand a practical example of integrated education. They would thus be better prepared for teaching in an integrated way. Moreover, teachers who can teach about conservation problems and solutions also will be making a contribution to their student's comprehension of conservation in El Salvador.

Human health and the environment are linked in many ways. Gastrointestinal and respiratory diseases, the two most serious diseases in El Salvador, originate in contaminated environments, dirty water and smoky air. Forested watersheds generally provide cleaner and more abundant supplies of the water that people need to stay healthy. Health education programs that link clean and abundant water contribute to human health would also transmit a principal conservation message to many people.

#### **Democracy and Governance**

There are multiple links between democracy, governance and conservation of biodiversity and forests. Local politics and governance, for example, often concern environmental issues, such as the provision of clean and abundant water, and the disposal of solid and liquid waste, that affect biodiversity and forests. El Salvador's municipalities have wide-ranging powers to regulate land and water use. For these reasons, democracy and governance and conservation programs can reinforce each other in many ways.

### **Economic Growth**

Poverty in El Salvador is concentrated in the same rural areas which are important for the provision of ecosystem services, especially clean and abundant water for human use, electrical power and irrigation. Payments for the ecosystem product of water that is returned to rural areas would not only protect ecosystems but could provide poor rural people with additional income. Ecosystem products and services, such as clean and abundant water and fertile soil in themselves make an important, although sometimes unquantifiable, contribution to economic growth.

### **3. Coordinating with other United States Government Agencies**

USAID/El Salvador coordination of the conservation activities it finances with two activities financed by or associated with the United States Government, the Millennium Challenge Corporation (MCC) and the Central America-Dominican Republic Free Trade Agreement (CAFTA-DR), would contribute to assisting El Salvador to conserve its biodiversity and forests. Certainly, it does not make sense for the United States government to finance activities in El Salvador with contradictory objectives. Coordination between US government agencies is required to avoid such an undesirable outcome and attain maximum efficiency in assisting El Salvador to conserve its biodiversity and tropical forests.

### **The Millennium Challenge Corporation (MCC)**

In 2007, the Millennium Challenge Corporation (MCC) made a grant of US\$461 million to El Salvador for the purpose of creating economic growth and reducing poverty in the Northern Mountains Zone. The funds will be used for (1) a road through the northern part of El Salvador from Honduras to Guatemala (US\$233.56 million); (2) development of tourism, dairies, vegetable and fruit production, handicrafts and tourism (US\$87.4 million); and (3) human development (US\$85.07 million). The project will prepare a map of the Northern Mountains Zone's ecosystems and protected areas (MCC, 2006).

MCC environmental regulations require an environmental impact assessment of

“perceptible impact on such locations, even if the project category does not appear in the above list. Such sensitive locations include national parks and other protected areas identified by national or international law, and other sensitive locations of international, national or regional importance, such as wetlands, forests with high biodiversity value, areas of archaeological or Projects that are planned to be carried out in sensitive locations or are likely to have a cultural significance, and areas of importance for indigenous peoples or other vulnerable groups (MCC, 2010).”

El Salvador's steepest terrain and most extensive secondary and primary forests are located in the Northern Mountains Zone. The Northern Mountains Zone is also where El Salvador's largest protected area, the Montecristo National Park, is located and where much of the water for El Salvador's hydroelectric projects originates. Thus, although relatively sparsely populated

and poorer than more urbanized areas, its ecological and economic importance to El Salvador is huge. The World Bank financed a strategic environmental assessment for the MCC program in El Salvador and the MCC has been utilizing its recommendations to identify, avoid or mitigate and monitor the direct environmental impact of the road's construction (Miller, K., pers. com., 2010). Neither the environmental assessment nor subsequent actions, however, have identified or mitigated the potential indirect negative impacts on forests, biodiversity or protected areas that the road or other activities financed by the MCC may cause. Road improvement and construction projects invariably do stimulate changes in land use and therefore cause impacts on natural habitat (FOMILLINIUM, 2006).

According to a newspaper article, El Salvador may have seriously failed to enforce the environmental standards required for all MCC projects (LPG, 2007). It would be useful to both the USAID/El Salvador and MCC activity if they were to coordinate on assisting FOMILLINIUM and MARN to enforce the required standards.

- Central American-Dominica Republic Free Trade Agreement (CAFTA-DR)

The CAFTA-DR is a free trade agreement between Central America, the Dominican Republic and the United States. A four-year (2006-2009) preparation period was financed by US\$40 million from the United States. Half of these funds are being used to improve the capabilities of public institutions in Central America and the Dominican Republic for resolving environmental issues. The environmental program will be completed at the end of 2010.

In El Salvador, MARN, the Office of the Attorney General, judges, and private environmental consulting firms have received assistance under this program. The program also has strengthened El Salvador's environmental impact assessment process and the implementation of CITES (Nieto, S. 2009). The program has fostered public-private sector cooperation and has worked to resolve environmental issues and meet international environmental standards as a means to increase the international competitiveness of Salvadorian products, especially coffee, poultry and cheese (Aguilar, R. 2009). USAID/El Salvador has and should continue to coordinate closely with the CAFTA-DR environmental activities.

#### 4. Coordinating with Other Donors

Table 9 indicates the principal conservation projects that are currently underway in El Salvador.

**Table 8 Summary of current conservation projects in El Salvador**

Title	Funding (US\$)	Institutions
4to Informe, Convenio sobre Diversidad Biológica	20,000	MARN/PNUD
Red Interamericana de Información Sobre Biodiversidad	20,000	MARN/OEA
Uso Seguro de la Biotecnología en El Salvador.	1,000,000	MARN/GEF
Biodiversidad, Pesca y Turismo	2,700,000	PNUD/GEF
Manejo Integral, Área Protegida Montecristo (3 países)	3,500,000	Vice Presidencia
Mejor Manejo de Cuencas Hidrográficas Críticas	12,235,644	MARN/USAID DAI
Fortalecimiento Institucional, Gestión de Cuencas	485,000	MARN/AECID
Administración y consolidación de Áreas Protegidas	5,000,000	MARN/BM/GEF
Refuerzo Presupuestario Institucional. Fortalecimiento	499,000	MARN/UFI.
Gestión de Ecosistema Marino Costero.	60,000	MARN/CCAD

Title	Funding (US\$)	Institutions
Corredor Mangle Jiquilisco / Jiquilillo	1,600,000	AECID/ CCAD
Manejo Integrado de los Ecosistemas del Golfo de Fonseca	5,000,000	MARN/GEF/BID.
Bosque y Agua	4,000,000	MARN/KFW/ GTZ
Comunicación Nacional de Cambio Climático	0	MARN
Economía del Cambio Climático	0	CEPAL /UK .
Emisiones por Deforestación y Degradación	200,000	BM
Indicadores de la Ecoregion	0	MARN
TOTAL	30,885,000	

Source: MARN, 2009

The first two projects on the list are particularly relevant to USAID/EI Salvador's country strategy. The first one involves the preparation of a report on El Salvador's compliance with the Biodiversity Convention. The second project is planning a system for collecting information about biodiversity in El Salvador. It is at this stage of projects that USAID/EI Salvador should be sure to coordinate with the MARN and other donors. Later on, when projects have already been design or are being implemented coordination is not as likely to be as useful. Regular meetings between USAID/EI Salvador and representatives of other conservation projects in El Salvador would be useful to ensure coordination of assistance and policies. USAID/EI Salvador, however, should always respect and support MARN's role as the coordinating ministry for conservation actions in El Salvador.

## B. ENVIRONMENTAL IMPACT ASSESSMENT

USAID/EI Salvador can contribute to the conservation in El Salvador by ensuring that the activities it finances do not cause adverse impacts on El Salvador's biodiversity and tropical forests and by assisting MARN to systematically include impacts on biodiversity and tropical forests in its environmental assessment regulations, methodologies and reviews.

### 1. Environmental Assessment of Activities Proposed for 2010 to 2014

USAID Environmental Regulations, in Section 216 of the Foreign Assistance Act, require that the potential positive and negative environmental impacts of the activities USAID finances be reviewed. Thus an environmental review will be required for any activity that USAID/EI Salvador may propose as part of its strategy for 2010 to 2014. If the review indicates that the proposed activity may cause adverse impacts on tropical forests and biodiversity, then an Initial Environmental Examination (IEE) must be prepared. If the IEE indicates that a proposed action will be likely to cause significant negative impacts on biodiversity or tropical forests, then usually an environmental assessment of the proposed action will be required. The environmental assessment assesses the degree of impact the proposed action will have on tropical forests and biodiversity and formulates measures to avoid, mitigate or compensate for those negative impacts. It also makes a recommendation to decision makers, based on environmental criteria, as to whether USAID should proceed with the proposed action. The following sections briefly review the potential environmental effects of the actions, as described previously that are likely to be proposed for financing to achieve USAID/EI Salvador's three Strategic Objectives for the period 2010 to 2014.

### Investing in People

A Categorical Exclusion probably will be given for the training and technical assistance activities under the “Investing in People” Strategic Objective. Since only offices that already have adequate water and sanitation infrastructure will be selected for rehabilitation, USAID financing will not be used to rehabilitate water and sanitation infrastructure. Environmental reviews of these small-scale, re-modeling projects will be required, but they are unlikely to identify negative impacts on biodiversity or tropical forests.

The strengthening of the administrative and logistical capabilities of the Ministry of Health and other health-related institutions also is likely to receive a Categorical Exclusion. The purchase of medical supplies, likely to occur only if a large-scale medical emergency were to occur, also will be likely receiving a Categorical Exclusion. In any case, none of these activities will affect biodiversity or tropical forests.

### **Democracy and Governance**

The training and technical assistance activities under the Democracy and Governance Strategic Objective program will be likely to receive a Categorical Exclusion. The rehabilitation and remodeling of existing government offices for use as mediation centers will not involve water and sanitation infrastructure, so, although an environmental review of these projects will be required, they are likely to receive a Negative Determination or a Negative Determination with Conditions. They will not have any negative impact on biodiversity or tropical forests. They may have an indirect positive impact on biodiversity and forests if they improve the planning and operational capabilities of local governments.

### **Economic Growth**

Only training and technical assistance activities are proposed under the economic growth Strategic Objective for the period from 2010 to 2014. Regulation 216 permits such activities to be given a Categorical Exclusion, since they will not cause negative environmental impacts.

## **2. Assisting the MARN environmental review process**

According to the Minister of Environment and Natural Resources the environmental process supervised by MARN, which is almost identical to that of USAID, is ineffective and to some extent counterproductive. Rather than resolve conflicts over land use and access to natural resources the process sometimes stimulates more conflict. He also said that the environmental review process frequently occurs so late in the investment process that its results are ignored or too late to avoid adverse environmental effects or wasted investments. MARN does not have sufficient personnel who have the educational background required to prepare the scopes of work for environmental assessments or to review the environmental impact assessments once they have been completed. In El Salvador, there are 500 private sector consulting firms inscribed to make Environmental Impact Studies (EIS), but a MARN and CAFTA evaluation found that only 30 of these consulting firms actually have the competence required to prepare EIAs that meet minimal standards. Moreover, since the MARN staff does not have the expertise to evaluate these EIAs, they become stalled in MARN for long periods. Consequently, the environmental review process has become discredited.

The Minister said that USAID/El Salvador could contribute to the conservation of El Salvador’s biodiversity and tropical forests by providing assistance to the MARN to improve its environmental review process. Minister Rosa suggested that USAID/El Salvador arrange for the U.S. Environmental Protection Agency (USEPA) to provide expert assistance to MARN to speed up the EIS process and make it more technically sound, especially in areas related to water. USAID/El Salvador could also finance assistance for higher level professional education for Salvadorians who are or could become involved in the EIS process.

## **C. DESIGN AND IMPLEMENTATION OF CONSERVATION PROJECTS**

USAID/EI Salvador assistance to EI Salvador for the conservation of its forests and biodiversity will be effective if it (1) builds on the lessons of prior conservation experiences; (2) is designed to be technically sound; (3) reflects EI Salvador's conservation priorities; (4) is implemented efficiently and effectively using monitoring and evaluation to permit adaptive management; and (5) strengthens Salvadorian conservation institutions. The following sections discuss these requirements.

### **1. Build on prior experience**

Since 1984 and before, USAID/EI Salvador has financed a number of projects with conservation components. These projects include the Management and Rational Use of Water Project and the Generation of Employment Project. USAID/EI Salvador has also collaborated with the CAFTA-DR Environment program and, mostly through FIAES, has been tangentially involved in the activities of SalvaNATURA, the National Zoological Foundation and other Salvadorian environmental NGOs. Table 13 lists 13 other conservation projects that have been recently implemented in EI Salvador, most of them financed by international aid institutions. Future conservation actions financed by USAID/EI Salvador should learn from and improve upon the conservation experiences of these projects.

Most recently, USAID/EI Salvador has financed the Improved Management and Conservation of Critical Watersheds Project (IMCCW). IMCCW has supported the conservation of biodiversity and revenue generation in the hydrographic regions of Barra de Santiago/EI Imposible and Rio Grande of Sonsonate, working with MARN, MAG, local governments, NGOs, local committees and associations, and private enterprises. From the end of 2009 through December 2010, the project, working through the National Zoological Foundation (FUNZEL), has been concentrating on increasing the number of marine turtles hatching and returning to the ocean from EI Salvador's beaches and on improving the management of the Montecristo National Park. As the most recent of the conservation projects that USAID/EI Salvador has financed, it is particularly important that IMCCW be thoroughly and objectively evaluated for its effectiveness in contributing to the conservation of EI Salvador's biodiversity and forests.

USAID/EI Salvador funds have also directly or indirectly financed projects carried out by SalvaNATURA and under the auspices of FIAES. These projects have occurred in many parts of EI Salvador and have involved various different aspects of conservation. They have been lessons to teach about how to carry out conservation in EI Salvador effectively.

This report recommends that USAID/EI Salvador finance an evaluation of prior conservation projects in EI Salvador. The evaluation should be organized to compare the effectiveness of different models of conservation actions. It should examine the experiences of conservation projects that were financed by USAID/EI Salvador but also other conservation projects that have been implemented in EI Salvador. The evaluation would require 4 person months and cost about US\$60,000.

### **2. Ensure technical soundness**

The technical soundness of the conservation actions USAID/EI Salvador finances will depend on the degree of expertise, local knowledge and care with which they are designed and

implemented. To ensure technical expertise, USAID/EI Salvador must contract the best possible technical experts in different aspects of conservation to select, design and implement the conservation actions it will finance. For that reason, it is important that USAID/EI Salvador establish its conservation priorities before contracting experts to design specific conservation actions. A different expertise is required, for example, to design a conservation program inside than outside of a protected area or to design a conservation education rather than a conservation communication program. To ensure the incorporation of the vast experience of Salvadorians in the projects it finances, USAID/EI Salvador should contract Salvadorian conservation experts to participate in the design and implementation of its conservation actions. Salvadorian experts can bring to the design years of experience in observing the ecology of the specific geographic areas where conservation actions are required. To ensure that the design process is carried out with sufficient care, USAID/EI Salvador should plan its design process to meet its deadlines without undue hurry and pressure. It should consider the design process itself as an important conservation action and give it the time it requires in order to produce a technically sound design.

### **3. Monitor, Evaluate and Adapt**

Conservation activities require a sound, appropriate methodology for objectively monitoring and evaluating progress towards achieving the planned inputs, outputs, outcomes and results. Without constant monitoring and frequent evaluation of the data monitoring produces it is not possible to know if the conservation objectives are being reached. Nor is it possible to adapt the project to more effectively and efficiently attain the defined conservation objectives. The process of monitoring, evaluation, and adaptation has become an integral part of most natural resource management professional practice. USAID/EI Salvador should therefore include an objective monitoring and evolution component in all the conservation activities it finances.

### **4. Strengthen Salvadorian institutions**

All of the conservation actions USAID/EI Salvador finances should contribute to strengthening Salvadorian institutions that have a role in conserving its forests and biodiversity. USAID/EI Salvador financing for conservation actions will never be sufficient or last long enough to in itself achieve the conservation of EI Salvador's forests and biodiversity. In any case, conservation must continue essentially forever, so it is the proper task of Salvadorian not foreign institutions to implement conservation actions. USAID/EI Salvador financing for conservation actions should always concurrently be strengthening the permanent Salvadorian institutions which have the responsibility for conserving EI Salvador's forests and biodiversity.

## **D. NEEDED CONSERVATION ACTIONS**

This section discusses ten categories of conservation actions that are needed in EI Salvador in order to conserve its biodiversity and tropical forests, as described previously in the section on the methodology of this report. For each category of conservation action, the report discusses its justification, identifies the gaps in the data available about the action for the preparation of this report, summarizes the current status of the category of action in EI Salvador, and notes the principal issues and priority actions that are required to improve the effectiveness of the category of action.

## **1. Conservation within Protected Areas**

### **Justification**

The establishment of protected areas is a core, essential requirement for conserving any country's biodiversity and forests. Protected areas conserve the natural habitat which a country's threatened and endangered species require in order to survive as a viable population within the country. Often the required habitat is primary vegetation that has not been influenced excessively by human actions such as burning, extraction of some species, or changes in land use. Even if part of the habitat has been influenced by human actions, within a protected area it can be permitted to grow without further human influence, sometimes developing characteristics that are similar to those of primary habitat. Although protected areas may be used for other purposes, such as recreation, in El Salvador, which has so little protected area, the principal purpose of its largest protected areas is the protection of rare, threatened and endangered ecosystems, species and genes.

### **Gaps in Available Information**

Data about the size, area and number of El Salvador's protected areas should be considered approximate and tentative, rather than exact, because they change as the legalization process for the areas proceeds and because various reports have been published without ensuring the accuracy of their data. There are almost no data available in MARN about the condition of the vegetation in any but the larger protected areas. At the beginning of 2010, the DGPN had begun an inventory of all the protected areas in SANP with the objective of determining their legal status, size, and ecological condition. The results of this inventory should clarify the status of the protected areas within SANP.

Except for some butterflies, little is known about the life cycles and symbiotic and ecological relationships of most of the species of the plants, animals, fungi, algae and protozoa that live in El Salvador's protected areas. Likewise, little is known about the daily and seasonal movements of animals between the protected areas and their surroundings or about the role of the protected areas in providing habitat for migrating birds and bats. Few data are available about the quantity and quality of the water that flows out of the protected areas or the current condition of the areas' habitat. In sum, little basic information about the ecological aspects of El Salvador's protected areas was available for the preparation of this report, so the analysis of their ecological status is inevitably limited in its detail and scope.

Also, few data are available about the resources available for the management of the public or private protected areas, such as their budgets, personnel, infrastructure or equipment. For this report, therefore, it was not possible to analyze in any detail the functioning of El Salvador's protected area system.

### **Status of the Conservation Action**

El Salvador's System of National Protected Areas (SANP) consists of all the protected areas owned by the national government and municipal governments and those privately owned areas that have been enrolled with MARN. SANP also includes all of El Salvador's mangrove forest. Map 3 shows the location (marked in dark green) of the larger areas that form part of the SANP. The map clearly indicates that only a small part of El Salvador has been reserved for protected areas. It also shows that there are a greater number and a larger total area of protected areas in western than in eastern El Salvador. The map shows no protected areas at all in the northeast mountains. There is only one marine protected area, off the western coast (shown in blue on Map 3) but there are a number of protected areas that include beaches and estuaries. Map 3 shows that there are protected areas established for all of El Salvador's 11 vegetation

types, as classified by Lauer, except for the chaparral and the pine-oak vegetation type in the northeast and the morral type in eastern El Salvador.

Most of the areas included in SANP were reserved for protection under a provision of the land reform decree of 1980. When the Institute for Agrarian Reform (ISTA) intervened in a property as a part of the land reform, it reserved the parts of the property that still had natural vegetation for designation in the future as publicly owned protected areas. As a result, many small, dispersed plots of land which still had natural vegetation when the land reform process was implemented were reserved for public ownership rather than being included in the land that was distributed to the rural poor. Properties adjacent to national boundaries with Honduras and Guatemala, however, were excluded from the land reform process. For that reason, there are still some large private properties along the northern border of El Salvador, particularly around the Montecristo National Park. Some of these properties have relatively large areas of primary forest habitat.

The process of transferring the reserved properties from the control of ISTA to the national government involves a field inspection, a technical report, approval by ISTA, and an Act of Transfer of the Area. The property must then be registered in the National Center of Register (CNR) and MARN must prepare and issue a Decree of National Protected Area (MARN, 2005). The national government has not allocated MARN or ISTA the resources required to carry out and complete this transfer process expeditiously. Table 9 indicates the status of the SANP as of 2005 according to MARN, including private and municipal protected areas as well as the areas that were already or in the process of being transferred from ISTA to the national government.

**Table 9 Status of protected areas in 2005**

Types of Protected Areas	Number	Area (ha)	Percent
In process of being transferred to the state from ISTA	25	6,303	16
Transferred to the state to be assigned to MARN	66	14,711	37
State (MAG)	6	7,172	18
State (ISTA)	2	770	2
Municipal	6	927	2
Private	13	10,092	25
<b>TOTAL</b>	<b>118</b>	<b>39,976</b>	<b>100</b>

Source: MARN, 2005

Table 9 indicates that in 2005 there were 39,976 ha, in 118 different areas that were already reserved in protected areas or in the process of being transferred from ISTA to MARN to be reserved in protected areas. Of these areas, 97, with a total area of 28,156 ha, or 72 percent of the total area, had been or were in the process of being transferred to the control of MARN or MAG. There were six areas registered under the control of municipal governments,<sup>13</sup> with a total area of 927 ha. Thirteen areas, with 10,932 ha, representing 25 percent of the entire protected area in SANP, were under private ownership. Many of the public areas were degraded and fragmented (MARN, 2005).

<sup>13</sup> However, just the Izalco volcano – which is municipal property - has 2,000 ha, so the figure for municipal protected areas is an underestimate.

Between 2005 and 2009 the process of transferring land reserved for protected areas under the land reform from ISTA to MARN continued. Table 11 indicates the status of the process at the end of 2009 according to MARN.

**Table 10 Legal status as of 2009 of the areas reserved under 1982 land reform law**

Status	No.	Area (Ha)
Transferred by ISTA to MARN and inscribed	53	29,379
Transferred to the state but not inscribed	24	5,978
Technical report prepared	42	6,978
Other potential protected natural areas	23	10,057
<b>TOTAL</b>	<b>142</b>	<b>52,392</b>

Source: MARN, 2009

According to MARN, as of the end of 2009, of 142 areas, with a total area of 52,392 ha, that had been under ISTA control, 53 had been transferred to MARN and inscribed as government property, and 25 had been transferred to MARN but not yet inscribed. Technical reports had been prepared for 42 areas. Twenty-three areas were still under the control of ISTA.

Table 9 indicates that as of 2005 there were 10,092 ha of in private protected areas, 927 ha in municipal protected areas and 7,172 ha in protected areas controlled by MAG.<sup>14</sup> The sum of these areas is 18,191 ha. If this number of hectares is added to the 52,392 ha indicated in Table 10, then the total number of hectares in the SANP would be 70,583 ha. Table 9 indicates that in 2005 there were 21 protected areas not under the control of MARN. Table 10 indicates that there are 144 protected areas that are already or potentially to be under the control of MARN. These figures indicate that El Salvador has 165 existing or potential protected areas. Tables 9 and 10 indicate that of these 165 areas, 53 public areas, 13 private areas, 2 state areas and 6 MAG areas had been legally declared protected areas. Assuming that no further private, municipal, state or MAG areas have been legalized since 2005, at the end of 2009 there would have been a total of 74 legally declared protected areas in El Salvador and 91 protected areas that have yet been legally established. The data available about the size and number of the existing and potential protected areas in El Salvador, however, are notoriously unreliable and the consultants for this report could not confirm the accuracy of these data, even though they were obtained from official MARN publications.

It was not possible to obtain a classification of the actual or potential areas in the SANP by their size in hectares. Most of the protected areas are small patches of natural vegetation immersed in landscapes that are dominated by crops, pasture and, in some places, secondary forest. Although local organizations probably know something about the condition of the habitat in some of these areas, as of the end of 2009, MARN had little information about these smaller areas. Although the vegetation of many of the smaller areas has been eliminated, degraded and fragmented, some of them probably still have remnants of primary habitat that could be important for maintaining the genetic diversity of many species. Some of the smaller areas also protect watersheds, thereby stabilizing water flows and reducing the risk of landslides. If adjacent land were to no longer be used for crops or pasture, these small areas could be the source for the seeds and animals needed to permit the restoration of natural habitat. These smaller areas are thus probably important for the conservation of ecosystem functions and for the conservation of El Salvador's biodiversity and forests.

<sup>14</sup> The areas listed as in under the control of MAG may actually be under the control of MARN and be double counted, according to Francisco Serrano. It was not possible to clarify this possibility.

Eight of the public protected areas, however, are absolutely essential for the conservation of a large portion of El Salvador's rare, endangered or threatened terrestrial biodiversity. Each of these areas includes more than 800 ha, and three have the possibility of being expanded to over 5,000 ha. Many of El Salvador's rarest, largest and most beautiful animals occur regularly only within these eight protected areas.<sup>15</sup> These eight protected areas also harbour most of the remaining reproducing populations of El Salvador's rarest and most threatened or endangered plant species. Some plant species now grow only within one or more of these eight protected areas.<sup>16</sup> Other individuals of plant species still exist outside of these protected areas, but many of them can no longer reproduce there for lack of their pollinators and seed dispersers. Table 11 indicates the names, general geographic location, dominant vegetation type, number of legally protected hectares, and status of the management plans of these eight priority protected areas.

**Table 11 Priority terrestrial national natural areas in El Salvador**

Name		Dominant Vegetation Type	Legally Protected Area (Ha)	Management Plan
<b>Legally Established</b>			9,973	
Montecristo	Northwest	Cloud, gallery & pine-oak forest	1,973	In revision
San Diego – La Barra	Northwest	Deciduous Dry forest	1,100	Yes
El Imposible	Southwest	Deciduous semi-humid & gallery forest	3,700	Yes
Los Volcanes	Central West	Cloud	2,200	Yes
Laguna El Jocotal	Southeast	Swamp	1,000	Yes
<b>Not Legally Established</b>			4,160	
San Sebastián Island	Southeast	Beach/mangrove	800	Status unknown
Nancuchiname	Southeast	Humid lowland & gallery forest	800	Yes
Barra de Santiago Zanjón del Chino – Santa Rita	Southwest	Humid lowland mangroves	2,460	Status unknown
<b>TOTAL</b>			<b>14,133</b>	

Source: MARN, 2009; Serrano, F. 1995

There are 14,133 ha in these eight protected areas. None of them has less than 800 ha. All the areas retain some intact primary vegetation (Serrano, F., per. com., 2009) although the proportion of degraded to intact vegetation in each area is unclear. Five of the areas, with a total area of 9,973 ha, are legally established. Three of the areas, with a total of 4,160 ha., had not been legally established as of the end of 2009. More of the eight areas are in western than in eastern El Salvador. None of the eight areas is in north-eastern El Salvador.

<sup>15</sup> These species may occasionally move outside of the protected area but they require the habitat of the protected area in order to survive as a species in El Salvador.

<sup>16</sup> At least 40 percent of the orchid species in the cloud forest of the Montecristo National Park, for example, occur no where else in El Salvador (Serrano, F., per. Com., 2009).

Between them the eight areas protect samples of the following eight of the 11 vegetation types in the Laur vegetation community classification for El Salvador: (1) cloud forest, (2) deciduous dry forest, (3) deciduous semi-humid forest, (3) beach vegetation, (4) mangrove forest; 5) gallery forest, 6) pine-oak, and (7) humid lowland forest. They do not include four vegetation communities: (1) chaparral; (2) morral forest, and (3) high savannah and (4) semi-humid savannah. One of the eight areas, Laguna El Jocotal, is a lake together with the surrounding severely degraded swamp vegetation.

Management plans have been prepared for seven of the areas, most of them with the assistance of the Tropical Agronomic Center for Research and Teaching Institute (CATIE). One of the plans, for the Montecristo National Park, is being revised with the assistance of the IMCW which is financed by USAID/El Salvador. The status of the management plan for San Sebastian Island could not be determined.

### **Principal Issue and Priority Actions**

- *Completing transfer of reserved areas from ISTA to MARN and municipal governments*

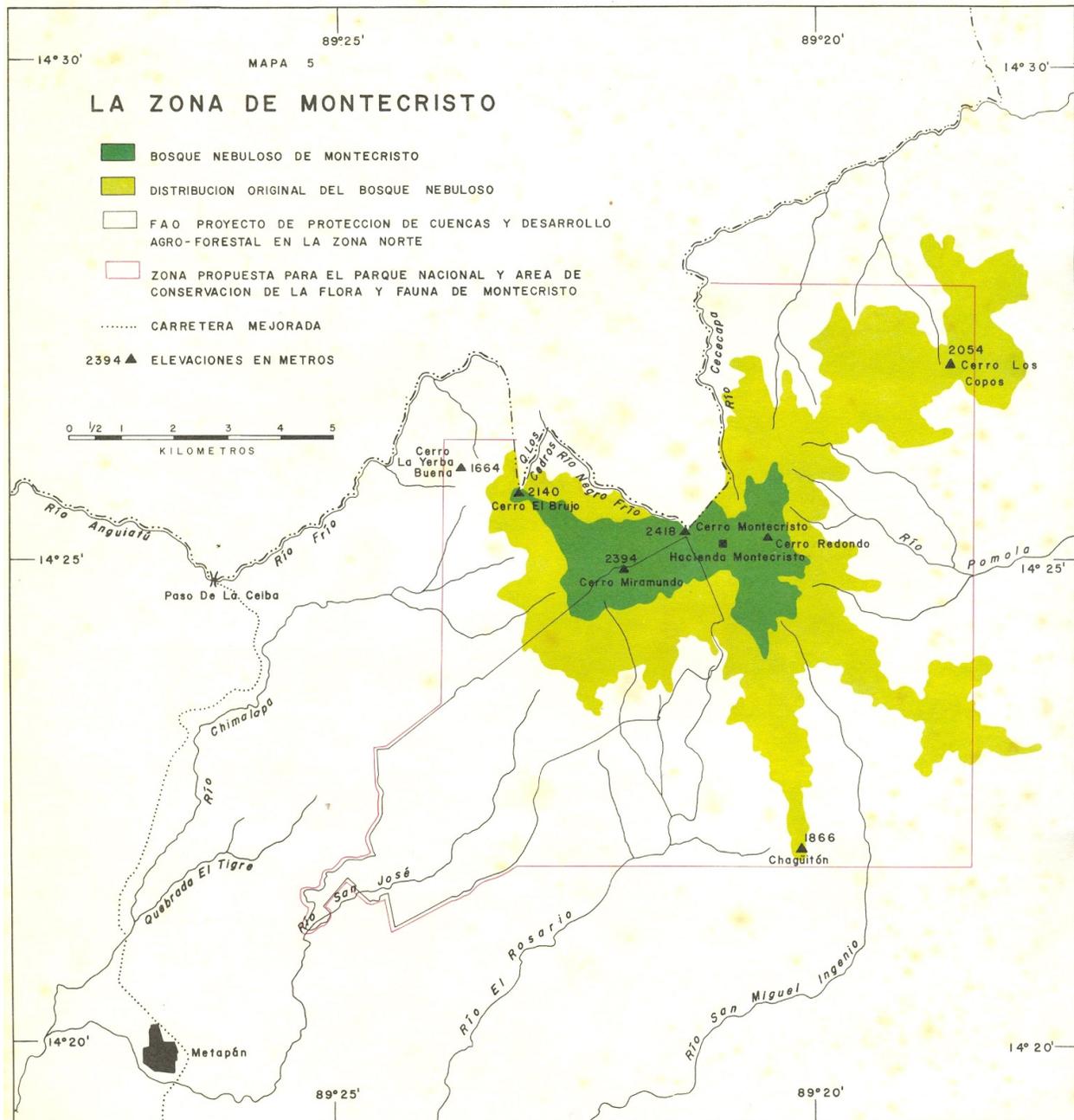
Only 53 of the 142 areas that were to become protected areas under the provisions of the 1980 land reform have been conveyed from the Institute for Agricultural Reform (ISTA) to MARN. As discussed previously, these areas are threatened by invasions and elimination or degradation of their vegetation. After 30 years it is certainly time for El Salvador to finish the transfer of these areas from ISTA to MARN. Most of these areas, however, are too small to remain under the administration of MARN, which should concentrate its attention on El Salvador's few large national protected areas. Most of them, therefore, should be transferred to the control and administration of the local municipal governments. A priority action for conservation in El Salvador is to establish an inter-institutional task force with staff from ISTA and MARN that would evaluate the legal and biological status of each small protected area in consultation with municipal governments and supervise the legal transfer to them of control over these areas. ISTA would require the resources necessary to delimit, measure and legalize the areas that have not yet been transferred to MARN. This report recommends that USAID/El Salvador provide sufficient financial assistance to ISTA and MARN so that they can do the field and office work required to finalize the status of the 89 areas that remain of the 142 areas. This work would include the transfer to the control of municipal governments of those areas which are too small to be practical to keep under the control of MARN. The estimated cost of this priority action is US\$500,000.

- *Expanding the size of the large protected areas*

Some of the large animals that El Salvador has lost, such as the jaguar or harpy eagle, require contiguous areas of suitable habitat that are over 100,000 ha in size in order to survive as a species. These and other species also generally require a range of habitats that occur at different elevations, in order to complete all stages of their life cycles. Even the largest of El Salvador's protected areas, the El Imposible National Park, has only 3,700 ha. Thus, as previously discussed, El Salvador will never be able to re-establish wild populations of the largest species of animals that require such extensive areas of contiguous habitat in order to survive. Nonetheless, if the total contiguous area of protected, climax forest could be increased, and increased so as to include entire range of habitats that many remaining rare species

require, then the chances for survival in El Salvador of these threatened species of organisms would be improved.

Map 4, which indicates the boundaries Daugherty (1973) proposed for the Montecristo National Park, provides an example of how the boundaries of a protected area should be drawn according to technical criteria, so as to increase the range as well as the total area of habitat available for their threatened and endangered species.



**Map 4. Daugherty's proposal for the Montecristo National Park**

The boundaries Daughtery proposed for the Montecristo National Park include the entire cloud forest in the area, most of the oak and pine forests that surround the cloud forest and some of the broadleaf evergreen forest below the pine-oak forest. If the area within these boundaries were conserved, it would provide sufficient area and variety of natural habitat to ensure the survival of many of the threatened and endangered species that still live within the Montecristo National Park.

The effectiveness of El Salvador's other seven large protected areas for the conservation of forests and biodiversity also would be greatly increased if their boundaries were to be similarly defined based on technical criteria and then actions taken to protect the primary habitat within those boundaries. Preferably, the national government would purchase outright the land with suitable habitat that lies adjacent to the boundaries of these eight protected areas. In most cases, however, outright purchase is unlikely to be possible. Permanent arrangements could perhaps be negotiated and financed with the owners of the land to protect the habitat that the threatened and endangered species require.

A priority action, therefore, is to study how it would be possible to expand the effective size of the eight protected areas listed in Table 6 in order expand their effective area of protection of the habitat required by rare, threatened and endangered species. The study would include the determination of the ideal boundaries for larger protected areas. It would also have to include, however, an analysis of what practical means exist in each area for achieving such an expansion, including outright purchase or long-term arrangements with the owners of properties that lie adjacent to the protected area. The study would require approximately four person months per area. An estimate of the total cost is US\$480,000.

- *Representativeness of the protected areas in SANP*

El Salvador's National System of Protected Areas (SNAP) should include representative areas of all of the country's vegetation types. Map 3 and Table 12 indicate that the public areas in SANP do not include the oak-pine and chaparral habitats of north-central and north-eastern El Salvador. Public land is not yet available in Morazán for the establishment of one or more publically owned protected areas, so the government may have to purchase private land to establish national protected natural areas there, and encourage the establishment of private protected areas to complement the public protected areas and increase their effectiveness for biodiversity conservation.

A priority conservation action, therefore, is to make a technical analysis of where and how it would be possible to establish national protected areas in the habitats that are not represented in the SANP, especially in northeast El Salvador. Such a study would require three person months and would cost US\$45,000.

- *Management plans for the protected areas*

Management plans for protected areas should guide the conservation of their biodiversity. Many of El Salvador's protected areas lack any management plan. Those management plans that have been prepared often have not been based on ecological knowledge, such as carrying capacity, dependence relationships with neighbouring ecosystems, habitat requirements, reproduction habits, daily or seasonal movement patterns, and diet and food sources. Without such knowledge, they cannot establish conservation objectives for their threatened or endangered species. Few management plans for protected areas in El Salvador, therefore, even those prepared with international cooperation, have served as fully useful tools for guiding actions to conserve biodiversity and forests (DGPN/MARN, 2009).

A priority action, therefore, is to prepare or revise the management plans for the eight priorities protected areas, based on field information. Obtaining such field information will require field studies by interdisciplinary teams of competent scientists and will take at least a year. Each plan will cost about US\$80,000 so the budget for this action would be US\$640,000.00.

## **2. Conservation Outside of Protected Areas**

### **Justification**

El Salvador's protected areas altogether includes less than three percent of the national territory. Even the largest of them have only a few thousand hectares. They need to be connected to each other by habitats which could serve as corridors for the movements of the more wide-ranging animals. Conservation within the National System of Protected Areas (SANP), therefore, does not by itself adequately protect El Salvador's biodiversity and forests. The conservation provided by the SANP needs to be supplemented by conservation outside of the protected areas.

### **Gaps in the Data**

Secondary forest is the largest single area of land use in El Salvador. But other than for birds, there are few data on the species that inhabit secondary forest. Also, few data are available about the geographic location of secondary forest in relation to El Salvador's larger protected areas.

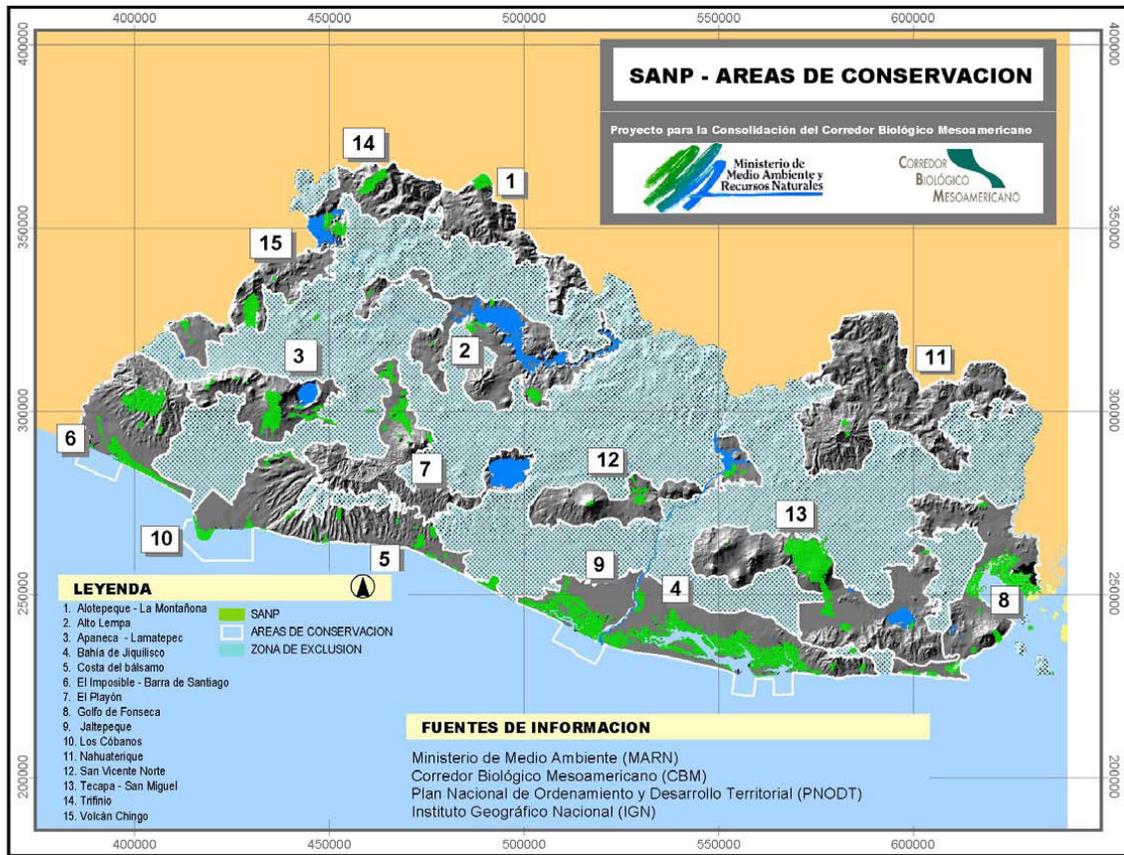
A number of conservation projects, including some financed by USAID/El Salvador, have been implemented outside of protected areas. If objective evaluations of these projects exist, they were not available for the preparation of this report.

### **Status**

MARN has defined four categories of areas that are important for conservation but that lie outside of the protected areas: Conservation Areas, Biological Corridors, Ramsar Sites, and Biosphere Reserves. SalvaNATURA also has identified Important Bird Areas and Key Biodiversity Areas. The biodiversity and forests that occur outside of protected areas also are important. The following sections briefly discuss each of these types of areas.

- *Conservation Areas*

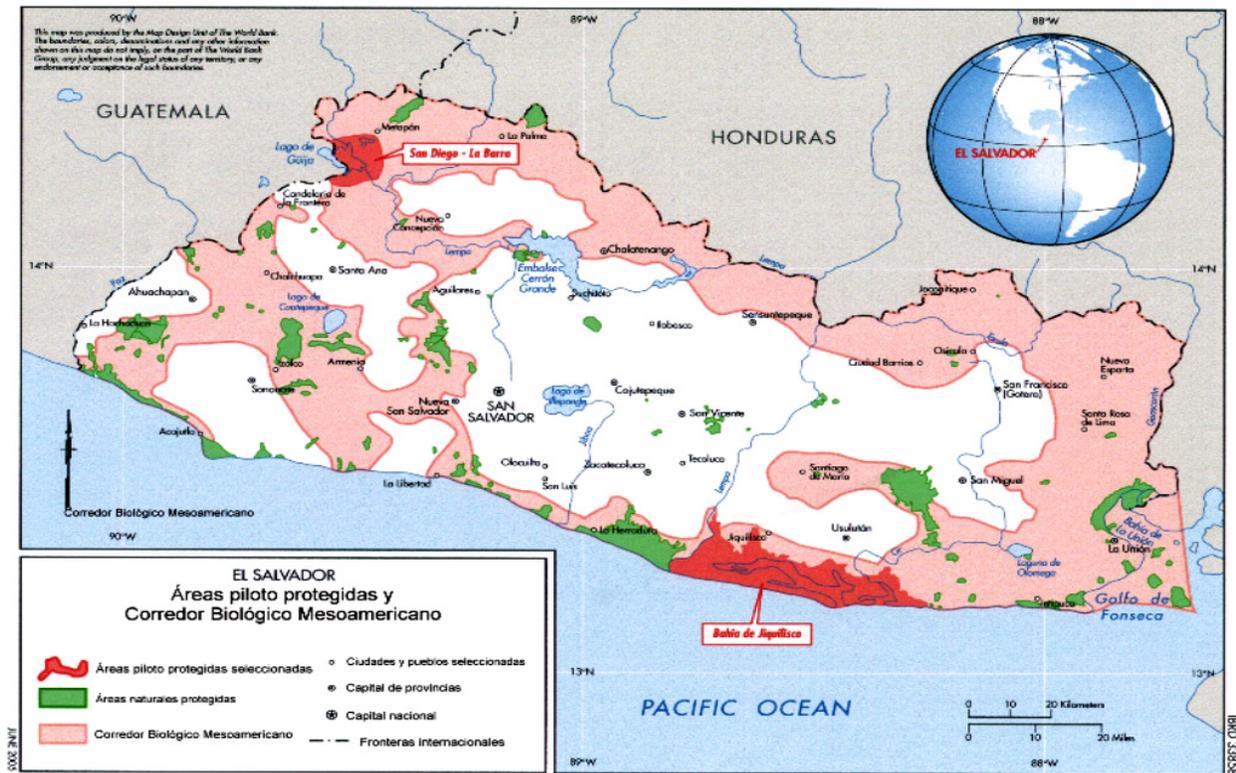
In 2004, the National Plan for Managing and Developing Territory (PNODT, 2004) delimited Conservation Areas. The Law of Natural Protected Areas defined a Conservation Area as "a territorial space that contains Natural Protected Areas, buffer zones, biological corridors and zones of influence, functioning integrally and administered through the application of the ecosystem approach, with the purpose of promoting sustainable development" (MARN, 2006). El Salvador has fifteen Conservation Areas, within which are 87 protected areas with a total area of 75,069 ha, including mangrove forests (MARN, 2006).



**Map 5. Conservation areas in El Salvador**

### Biological Corridors

A biological corridor connects protected areas and theoretically at least allows for the flow of genetic material of living organisms between them. MARN has delimited four biological corridors in El Salvador: the Gulf of Fonseca; the Trifinio; the Bahía de Jiquilisco - Estero de Jaltepeque, and the Barra de Santiago – Monterrico, all considered as sub-components of the Mesoamerican Biological Corridor. Map 6 indicates the location of these biological corridors.



**Map 6. Biological corridors and protected areas in El Salvador**

- *Ramsar Convention Sites*

The Convention on Wetlands of International Importance, referred to as the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources ([www.ramsar.org/cda/ramsar](http://www.ramsar.org/cda/ramsar)). El Salvador currently has three Ramsar sites. The Laguna El Jocotal, declared in 1999, is a fresh water lake of 1,200 ha located on the coastal plain. Its habitat is important for both native and migratory, fresh-water birds. In 2005, 63,000 ha of the Bahía de Jiquilisco and the Cerron Grande reservoir were also declared Ramsar sites. The former has extensive mangrove forests and the latter provides habitat for migrating birds. The only management action that has taken place in these Ramsar sites has been a prohibition on the exploitation for five years of any type of floral or faunal resource in two areas of mangrove forest in the Bahía de Jiquilisco, totaling 1,747 ha (Komar, o. & Ibarra-Portilla, R., 2009). Map 7 indicates the location of El Salvador's Ramsar sites. The government has initiated the process for designating the Lago de Guija and the Laguna de Olomega as additional Ramsar sites.

- *Biosphere Reserves*

A biosphere reserve is a voluntary, cooperative, conservation reserve created to protect the biological and cultural diversity of a region while promoting sustainable economic development. Biosphere reserves are established under the auspices of United Nations Educational, Scientific, and Cultural Organization (UNESCO) Programme on Man and the Biosphere (MAB). As of 2009, there were two biosphere reserves in El Salvador, the Apaneca-Llamatepec

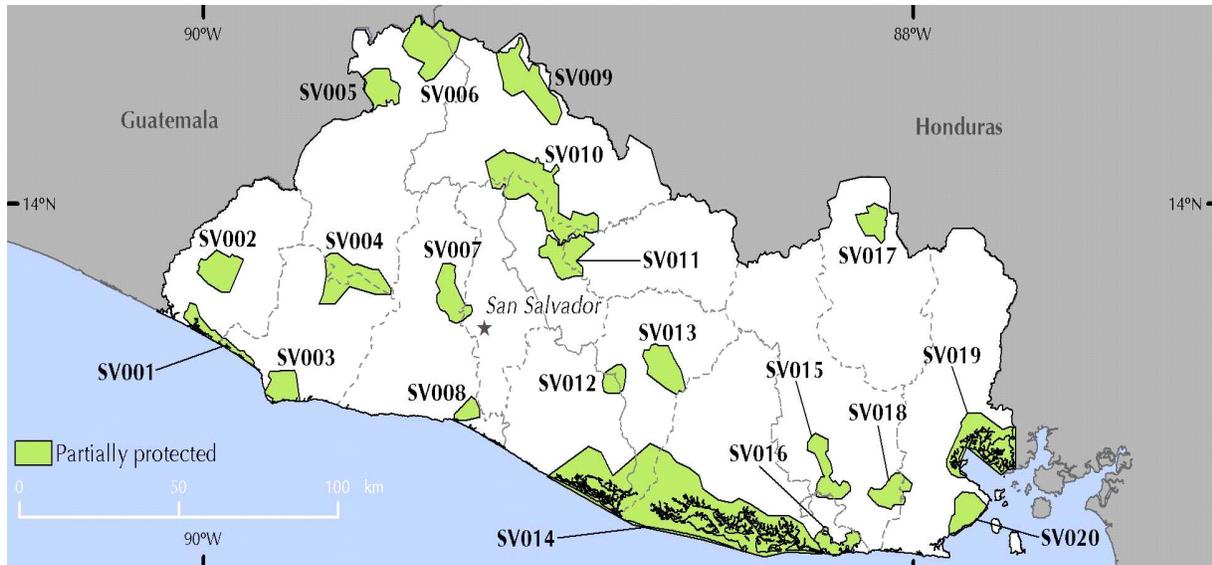
Biosphere Reserve and the Los Volcanoes Biosphere Reserve. Map 7 indicates the location of these biosphere reserves.



**Map 7. Ramsar and biosphere reserves in El Salvador**

- *Important Bird Areas*

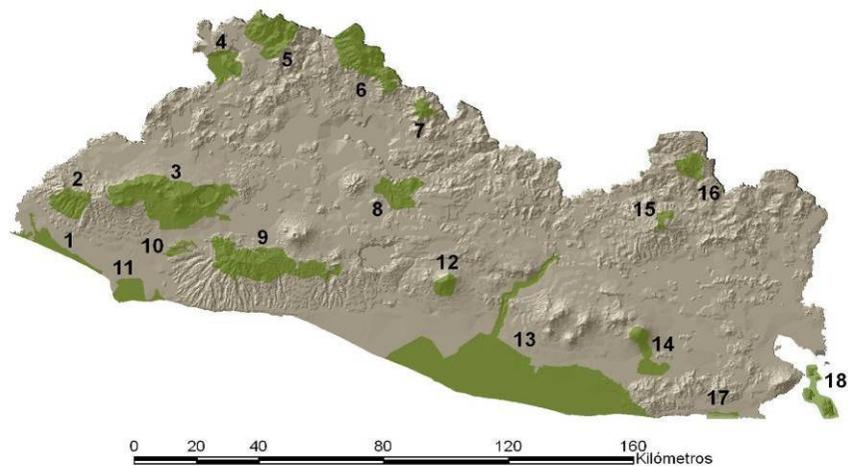
Important Bird Areas (IBA) are globally important areas for the conservation of birds according to criteria that have been established by Birdlife International. In El Salvador, SalvaNATURA represents Birdlife, Int. and has identified the IBAs shown on Map 8 (Komar, O. et al, 2009).



**Map 8. Important bird areas in El Salvador**

- *Key Areas for Biodiversity (KABs)*

SalvaNATURA has used registers for the 48 species of globally threatened flora and fauna that occur in El Salvador to delimit the 18 key areas for conservation of biodiversity that are shown on Map 8 (Komar, O, 2009). Various of these areas coincide with El Salvador's larger national protected areas. In Morazán Department, however, there are two key biodiversity areas (15 and 16) but no national protected areas.



**Áreas Clave para la Biodiversidad (ACB)**

- |                                    |  |
|------------------------------------|--|
| 1. Complejo Barra de Santiago      | 10. Complejo Los Farallones                  |
| 2. Bosque El Imposible             | 11. Complejo Los Cóbanos                     |
| 3. Sierra de Apaneca - Ilamatepec  | 12. Volcán de San Vicente                    |
| 4. San Diego - La Barra            | 13. Jiquilisco y Jaltepeque                  |
| 5. Bosque Montecristo              | 14. Volcán de San Miguel - Laguna El Jocotal |
| 6. Sierra de Alotepeque            | 15. Complejo Cacahuatique - San Carlos       |
| 7. La Montañona                    | 16. Río Sapo - Perquín                       |
| 8. Bosque Cinquera                 | 17. Humedales de El Icacal                   |
| 9. Cumbre de la Sierra del Bálsamo | 18. Islas del Golfo de Fonseca               |

**Map 9. Key areas for biodiversity in El Salvador**

- *Buffer zones*

The effective protection and management of the eight large protected areas requires the delimitation of their buffer zones. Buffer zones would both complement the protected areas and provide a protective belt inwards, from pesticides, fires, and domestic animals, as well as outwards, especially from damage to crops by wild animals. The management plans for the eight protected areas have not addressed their need for buffer zones. In fact, government ministries and international projects currently are sometimes recommending agricultural practices that are neither feasible nor desirable in the buffer zones of these protected areas. Buffer zones should play an important conservation role around El Salvador's eight large protected areas. The size, shape and distribution of their buffer zones should be established based on technical criteria as part of the preparation of the management plans for these eight priority protected areas. Development projects outside of the eight priority protected areas should incorporate the concept of buffer zones into their plans and actions.

- *Other Areas of El Salvador*

The previous sections have noted seven types of terrestrial conservation geographic areas in El Salvador, six of which have been delimited on maps as particularly important for the conservation of biodiversity. Many other parts of El Salvador, however, also harbor important biodiversity. The common plants and animals that occur in El Salvador are often those that most directly benefit humans. In urban areas, for example, street and garden trees and plants, although not rare, may be some of El Salvador's most economically valuable plants, because they so improve the habitability of urban areas. El Salvador's secondary forest, likewise, although it is not the usual habitat for rare, threatened or endangered species of organisms, does have tremendous value for El Salvador's economy, because it protects the watersheds from which water for domestic, industrial, agricultural and energy generation flows. Secondary forests also have an enormous economic value because they reduce the risk of such natural disasters as floods and landslides, which can abruptly cause incalculable economic losses to individuals and the country as a whole. In sum, although the emphasis of this report is on the conservation of El Salvador's rare, threatened and endangered organisms and ecosystems, and its restricted areas of primary forests, El Salvador's more common types of organisms and forests do not also need and deserve conservation.

## **Principal Issues and Priority Actions**

- *Evaluation of conservation designations*

In El Salvador six different types of conservation areas, outside of the protected areas, have been delimited on maps for their importance for conservation of biodiversity. These areas were delimited as a guide the selection of priority geographic areas for implementing conservation actions outside of protected areas and increase the possibility for obtaining funding, training and technical assistance needed for to design and implement these actions. Such assistance, for example, sometimes comes more easily if geographic area has been officially declared a Ramsar site or a biosphere reserve. It would be useful to know, therefore, the extent to which the delimitation of these areas has or has not made a contribution to the conservation of biodiversity and why or why not. Such an evaluation, or study, could be combined with the evaluation of prior conservation actions that was recommended previously. If done separately, the evaluation would require approximately three person months and cost US\$45,000.

- *Evaluation of secondary forest*

Secondary forest is the most common type of forest outside of protected areas. Little is known, however, about its geographic distribution, plant and animal species, the growth rates of its principal tree species and its economic value. Such information will be important for designing and implementing actions to conserve and manage the secondary forest. Therefore an evaluation of the secondary forest is a priority action. Such an evaluation would require about six person months and would cost approximately US\$90,000.

### 3. Policies, Strategies, Laws and Regulations

#### **Justification**

The conservation of El Salvador's biodiversity and forests requires coherent conservation policies, strategies, laws and regulations. A conservation policy sets the conservation goals towards which Salvadorian society will work. A conservation strategy states how these goals will be achieved. Conservation laws establish the specific actions that will be taken or prohibited in order to implement the strategy. Conservation regulations specify the technical means that the government will use to enforce the provisions of the conservation laws.

#### **Gaps in the Data**

No objective evaluation was available for this report of how effectively the El Salvador's policies, strategies, laws and regulations in conserving El Salvador's forests and biodiversity are being implemented.

#### **Status**

- *International agreements and national laws and regulations*

Salvadorian legal documents related to the environment, natural resources, biodiversity and forests includes the international agreements, constitution, policies, laws, regulations, decrees and agreements. MARN's web site lists the international agreements, laws and regulations indicated in Tables 13 through 16.

Table 13 indicates that El Salvador is a signatory to the principal international environmental treaties. According to Salvadorian law, the obligations assumed under these treaties take precedence over national law.

#### **Table 12 International environmental agreements signed by El Salvador**

Convención Marco de las Naciones Unidas sobre Cambio Climático
Protocolo de Kyoto
Convención de las Naciones Unidas de Lucha contra la Desertificación
Convenio sobre Diversidad Biológica
Convención de Humedales de Importancia Internacional (RAMSAR)
Objetivos de Desarrollo del Milenio (ODM)

Source: <http://www.marn.gob.sv>

Table 14 indicates that El Salvador is a signatory to six regional conservation agreements. These are important treaties for El Salvador because it is Central America's smallest country and shares natural resources with its neighboring countries. The Lempa River, for example, originates in El Salvador, enters Honduras, and then flows back into El Salvador. In the Trifinio area, where the boundaries of El Salvador, Guatemala and Honduras meet, the three countries

share about 6,000 ha of primary forest. These treaties also facilitate the flow of technical information from the other Central American countries into El Salvador.

**Table 13 Regional conservation agreements signed by El Salvador**

Alianza Centroamericana para el Desarrollo Sostenible (ALIDES)
Plan Ambiental de la Región Centroamericana (PARCA)
Estrategia Forestal Centroamericana (EFCA)
Plan Centroamericano para el Manejo Integrado y la Conservación de los Recursos Hídricos
Iniciativa Mesoamericana de Desarrollo Sostenible en el Contexto del Plan Puebla–Panamá
Corredor Biológico Mesoamericano (CBM)

Source: <http://www.marn.gob.sv>

Table 14 indicates that El Salvador has policies concerned with environment, forestry, biodiversity, agriculture and research but none for land use planning and regulation and strategies related to environment, forestry, and biodiversity. No strategies appear on the web site for agriculture, fishing, land use planning and regulation or research

**Table 14 Policies and Strategies of El Salvador related to biodiversity and forestry**

<b>Environment</b>
National Environmental Policy
National Solid Waste Policy
National Policy for the Management of Residual Waters
Strategic Vision 2009-2014 and Initial Actions, Ministry of Environment and Natural Resources
Policy for Ordering the Use of the Coastal Marine Resources
<b>Forestry</b>
Forestry Strategy
National Policy for the Fight against Desertification
National Strategy for Financing Forestry
Plan for the Development of the Forestry Sector of El Salvador 2007-2025
<b>Biodiversity</b>
National Strategy of Management of Protected Areas and Biological Corridors
National Strategy for Biological Diversity
National Policy for Protected Areas
Policy Guidelines for Access to Genetic Resources
National Strategy for the Participation of Society in the Management of Natural Protected Areas
<b>Agriculture and Fishing</b>
National Policy for the Sustainability of Hydrological Resource
Policy for Organic Agriculture
<b>Land Use Planning and Regulation</b>
None identified
<b>Research</b>
National Policy for Science, Technology and Innovation

Source: <http://www.marn.gob.sv>, 2010; Catterson, T. et al, 2004, <http://www.conacyt.gob.sv>, 2010

Table 15 indicates the Salvadorian laws related to biodiversity and forests.

**Table 15 Salvadorian laws related to biodiversity and forests**

<b>Environment</b>
Law of the Environment
Dispositions of the Penal Code Related to the Environment
<b>Forests</b>
Forestry Law 1982
Forestry Law 2002 (not approved)
<b>Biodiversity</b>
Law of Natural Protected Areas
Law of Conservation of Wildlife
<b>Agriculture and Fishing</b>
Law of Fishing
Law of Secure Use of Pesticides
Law of Irrigation and Avenamiento
Law of Seeds
General Law of Planning and Promotion of Aquaculture
Law of Animal and Plant Health
<b>Land Use Planning and Regulation</b>
Law of Terrestrial Transport and Security
Law of Development and Territorial Planning of the Metropolitan Area of San Salvador
Law of Urbanism and Construction
Code of Municipalities
<b>Research</b>
Law of the National Council of Science and Technology

Source: <http://www.marn.gob.sv>; <http://www.fao.org/fishery/countrysector>

Table 16 indicates that El Salvador has a considerable number of detailed regulations related to the environment, but few related to biodiversity, forests, agriculture, land use planning and regulation and none related to research.

**Table 16 Salvadorian regulations related to biodiversity and forests**

<b>Environment</b>
General Regulation for the Law of the Environment
Regulation of the Law of the Environmental Fund of El Salvador
Regulation of Technical Standards of Internal Control of MARN
Special Regulation for Dangerous Substances, Residues and Waste
General Regulation of the Law for Civil Protection, Prevention and Mitigation of Disasters
Special Regulation for Environmental Compensation
Special Regulation for the Integral Management of Solid Waste
Internal Regulation of the National System of Environmental Management
<b>Forests</b>
Regulation of the Forestry Law
<b>Biodiversity</b>
Special Regulation for the Secure Management of Genetically Modified Organisms
Regulation for the Establishment and Management of Breeding Centers for Wildlife

<b>Agriculture and Fishing</b>
General Regulation of the Law of Irrigation and Avenamiento
Fishing Regulations
<b>Land Use Planning and Regulation</b>
Regulation of the Law of Development and Territorial Planning of San Salvador
<b>Research</b>
None listed

Source: <http://www.marn.gob.sv>

- *National Strategy for Biodiversity*

In 2000, in order to fulfill its commitment under the International Convention on Biological Diversity, El Salvador prepared a National Strategy for Biodiversity. Table 17 is taken directly from this document and indicates its principal priority areas and actions.

**Table 17 Priority areas and actions in the El Salvador National Strategy for Biodiversity**

Priority Area	Action 1	Action 2	Action 3	Action 4	Action 5
Inventory of National Biodiversity	Design a Museum of Natural History	Construction of a Museum	Complete National Herbarium	Identify & train taxonomists	Inventory national biodiversity
Conservation in situ and Ex Sit	Establish national system of protected natural areas	Establish private & municipal protected areas	Design & national zoo & botanical garden	Study & reproduce threatened species	
Education and Training	Identify conservation training priorities	Identify candidates for training	Identify training programs	Identify jobs for trainees en they return	Identify the best trainers among these professionals
Research & Agricultural Technology	Establish national policies & institutions to give incentives to research with a social function	Establish research priorities based on their potential traditional use and proposals of qualified people & institutions	Identify the human resources including foreigners with the most capacity to address the priority areas	Contract by product in the short and medium term	
Strengthening of the MARN	Integrate the principal institutions related to biodiversity	Integrate other relevant institutions such as the National Geographic Institute	Restructure MARN so that it can carry out its complex and interdisciplinary responsibilities		

Source: MARN, 2000

The biodiversity strategy, as summarized in Table 18, is less a strategy than a list of actions, some of them quite specific, such as the design, construction and operation of a Museum of Natural History. For this reason, the strategy has not served as a guide to the conservation of El Salvador's biodiversity and tropical forests. As of the end of 2009, MARN was preparing a report on El Salvador's compliance with the International Convention on Biodiversity for presentation at the meeting of the parties to the convention during 2010.

- *Forest Policy*

Over the last twenty years various documents have been prepared as the basis for promoting forestry in El Salvador. These documents include the "Plan for the Development of a National Forestry Enterprise Program" (2002), the "Forestry Strategy for El Salvador" (2006), the Plan for the Development of the Forestry Sector of El Salvador" (2007). None of these plans have been implemented (Chemonics, 2010). The "Program of the Government for the Five Year Period 2009-2014" includes the objective of "...fomenting the protection, conservation, restoration and management of forests..." The General Directorate for Forests, Watershed Management and Irrigation (GDFWMI), however, did not indicate to the consultants that it had a plan or resources to work towards this objective. The principal concern of its forestry staff appeared to be the control of movements of wood along the roads. The Director of GDFWMI said that the low level of its budget, limited personnel and lack of equipment do not permit it to promote forestry.

A component of the MCC project, the "Program for Increasing the Competitiveness of Forestry Chains in the Northern Zone", in January 2010 completed a comprehensive draft proposal for a forestry policy for El Salvador. According to this document,

"Until now, the political decision-makers have not recognized the strategic importance of the [forestry] sector and therefore have not incorporated it into plans for national development or given it any political priority...There is no official forestry policy in El Salvador to orient and modernize the national forestry sector" (Chemonics, 2010).

The study concludes that

"...the forestry sector should...guarantee security of land tenure, change the culture of exploitation that does not permit the recuperation of the forest; strengthen community forest management, promote mechanisms to give more value to standing forest, promote the participation of professional foresters in forest production and modernize the institutional structure for forestry (Chemonics, 2010).

It was not possible to determine the feasibility of these ambitious recommendations or the extent to which the Government of El Salvador is likely to incorporate them into the plans and budgets of its ministries.

- *Environmental Policy*

The most reliable source available for the preparation of this report regarding the government of El Salvador's current environmental policies and strategies for the conservation of biodiversity was the Minister of Environment and Natural Resources, Ing. Herman Rosa. In an interview, the Minister succinctly conveyed to the consultants his belief that "...conflicts over access to and use of land natural resources is currently the single most important cause of environmental problems in El Salvador." He said that such conflicts "...undercut economic growth by creating uncertainty, thereby reducing investment." He expressed his determination to stop "...the current ad-hoc approach to resolving such conflicts." He believes that "...conflicts should be

resolved through systematic, legal processes, many of them carried out at the local level through municipal governments, since they have more detailed knowledge than the national government can possibly have.” The minister expressed his belief that “...environmental issues affect all of El Salvador’s productive sectors and that MARN should play a cross-cutting, coordinating role between private sector enterprises, government ministries and local governments with respect to the resolution of environmental issues in El Salvador.”

### **Principal Issues and Priority Actions**

- *The President’s report on the state of El Salvador’s environment*

Minister Rosa told the consultant that in mid 2010 President Funes intends to give a report to the nation on the state of El Salvador’s environment, a yearly requirement in Salvadorian law. The Minister expressed his belief that USAID could provide him with assistance in the preparation of this report due to its local presence, technical expertise and ability to respond quickly to such a need. It is estimated that approximately 3 person-months of technical assistance would be required, at a cost of US\$45,000.

- *Policies for El Salvador’s secondary forest*

The widespread regeneration of secondary forests in El Salvador has given it a second chance to restore and conserve part of its ecosystems and biodiversity. Although it is so important for conservation in El Salvador, however, little attention appears to have been given to the future of the secondary forest. El Salvador needs a policy for protecting and managing this secondary forest, especially in relation to agriculture, watershed management, and protection of biodiversity and production of forest products. It should be carried out in after or in collaboration with the study of secondary forest recommended in the previous section of this report. Approximately six person-months of technical assistance plus other resources would be required, costing about US\$90,000.

- *Policies, Laws, Strategies and Regulations*

In the opinion of Minister Rosa, El Salvador “...has enough legislation related to protecting its environment...” and “...the emphasis of the government should be on enforcing existing legislation, not on writing new legislation.” The judgment of the minister carries a great deal of weight given his many years of experience and access to detailed knowledge of El Salvador’s environmental situation. The contents of Tables 16 and 17, however, suggest that perhaps some aspects of El Salvador’s legislation and regulation related to biodiversity and forests do need modification or strengthening. For example, the Forestry Law that was proposed in 2002 has not been approved, so the 1982 Forestry Law is still in force, although the condition of El Salvador’s forests has changed considerably since it was written. No law is listed that covers the use of fresh water, other than the irrigation law. Nor are their sufficient policies, strategies and laws related to marine and coastal waters. The laws governing land use planning may not include aspects of conflict resolution that would be useful making such planning less an academic and more a practical, effective conservation exercise. There is no law covering the management and protection of soils. This report, however, does not recommend that USAID/El Salvador provide support to the Government of El Salvador in matters related to policies, laws, strategies and regulations, unless perhaps the minister were to request such support.

#### 4. Conservation Research

##### Justification

Research on many aspects of biodiversity and forest is required in order to design and implement effective conservation actions. Such research should include not just biological or ecological aspects of the conservation of biodiversity and forests but also its social and economic aspects.

##### Gaps in the Data

So far as could be determined, there were no important gaps in data about the status of the research going on in El Salvador on biodiversity and forests, although it was not possible to obtain all the details of the research currently being carried out.

##### Status

Table 18 lists the principal Salvadorian institutions that carry out research on biodiversity and forests and their research specialties.

**Table 18 Institutions and individuals involved in biodiversity research**

<b>Institution</b>	<b>Types of Research</b>
Museum of Natural History, Ministry of Education (MUHNES)	Collections of plants, mollusks, insects, fishes, amphibians, reptiles, bird & mammals
National Botanical Garden	Inventory of the flora of El Salvador
School of Biology, University of El Salvador	Collections of invertebrates, insects, herbarium,
School of Agronomy Science, University of El Salvador	Collections of insects, teaching collections
National Center of Agricultural and Forestry Technology, Ministry of Agriculture & Livestock	Forestry and agricultural research
SalvaNATURA,	Monitoring of birds

Source: MARN, 2000

The Museum of Natural History, the National Botanical Garden, the School of Biology of the University of El Salvador, and the School of Agronomy Science all concentrate on making collections of plants or animals. The National Center of Agriculture and Forestry Technology carries out applied research in forestry and agriculture. SalvaNATURA's research mostly involves the monitoring of bird populations in different geographic areas and habitats. None of El Salvador's research institutions carry out ecological research.

SalvaNATURA appears to have the best-financed research program of any of these institutions. It has 15 biologists on its staff, a research budget of US\$300,000 per year, and carries out a program of systematic monitoring of bird population in several types of vegetation in El Salvador (Komar, O., per. com., 2009). No data was available on the financial, human and equipment resources that are available to El Salvador's other research institutions. Presumably they lack access to sufficient funds, staff and equipment to carry out more research than they are presently doing.

Independent researchers, unaffiliated with universities or other institutions and who finance their research themselves, are currently carrying out much of El Salvador's best research related to biodiversity. Often, however, these researchers do not publish the results of their research.

These independent researchers, therefore, have little influence on decisions that affect El Salvador's biodiversity and forests.<sup>17</sup>

Ex-situ conservation can be used to ascertain a rare or endangered species' reproductive, social and feeding habits.<sup>18</sup> In El Salvador ex-situ breeding programs also have been used to preserve some species of orchids and to reproduce some commercially valuable species of butterflies. The National Zoo has been successful in persuading the king vulture to reproduce in captivity. In theory it would be possible to reproduce rare species of trees in a botanical garden or through meristematic reproduction. The most logical sites for ex-situ plant breeding programs would be the botanical gardens of La Laguna and the Museum of Natural History. Although it would be reasonable for the National University to participate in ex-situ conservation programs, so far it has taken no steps to do so. Some private zoos in El Salvador are also involved in ex-situ breeding programs.

### **Principal Issues and Priority Actions**

- *Need for field conservation research*

El Salvador requires a serious program of field research in order to conserve its forests and biodiversity. Professional conservation disciplines, such as forestry, fisheries and conservation biology, use the data produced by reliable scientific field research. Such data, however, needs to be constantly validated, updated and improved through additional field research. The design and implementation of effective conservation actions requires up-to-date data on the status of forests, ecosystems and species. Little field research, however, is going on in El Salvador mostly because there is no regular source of financing for field research. Thus there are few field data concerning the state or exploitation of its biodiversity and forests. Little is known, for example, about the status of species that find habitat within protected areas. No monitoring is being carried out of the catches of marine organisms or of the exploitation of forests.

Knowledge of traditional uses of plants for medicines and foods is disappearing without being recorded.

El Salvador needs a fund whose income would be dedicated to financing conservation research. The design of a fund for research would require three months of technical assistance and cost US\$45,000. The initial size of the fund itself could be about US\$500,000.

- *Baseline data for climate change*

Changes in climate could affect El Salvador's forests and biodiversity, especially at the higher elevations of the northern mountains and close to sea level along the coast. The government is currently preparing a national agenda to mitigate the adverse effects of climatic change, including those on protected areas, wildlife and mangroves (Aguilar, Y. per. com., 2009). The agenda assumes that El Salvador's ecosystems have the resilience required for them to adapt quickly to climate change. No scientific baseline exists, however, against which to measure and evaluate climate change's adverse effects on biodiversity and tropical forests.

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<sup>17</sup> This observation is based on the personal knowledge of Francisco Serrano about what biological research is going on currently in El Salvador.

<sup>18</sup> The California condor, for example, was preserved from extinction through an ex-situ breeding program.

The baseline data would best be collected within the national protected areas and be part of the areas' management plans. Indeed, one of the purposes of protected areas is to maintain areas free from human influences to provide a baseline against which changes elsewhere can be measured and evaluated. The collection of baseline data would require a 12 months of monitoring in each of the eight areas. An estimate of the budget for this action is US\$240,000. The cost of subsequent monitoring would be part of the cost of managing the protected area.

## **5. Conservation Education**

### **Justification**

To conserve its forests and biodiversity, El Salvador requires adequate numbers of well-educated conservation scientists, professionals, technicians and workers, in a variety of professional fields, such as forestry, conservation biology, soil conservation, fisheries, wildlife management, watershed management, tropical ecology, marine ecology and coastal zone management.

### **Gaps in the Data**

No data were available regarding the number of Salvadorians who have been or are being educated in conservation fields. Nor was it possible to obtain any quantitative data on the budgets and personnel of El Salvadorian educational institutions or on their plans for expanding or changing their education programs. There were no data available on that could guide a recommendation on how many Salvadorians should be educated in what conservation disciplines and to what levels in order to supply adequately the need for conservation professionals.

### **Status**

As of November 2008, El Salvador had a total of 39 higher level educational institutions including 24 universities (1 public and 25 private), five specialized institutes (1 public and 4 private), 8 technological institutes (5 public and 3 private) (<http://www.conacyt.gob.sv>, 2010). There were 138,614 students attending these institutions.

As of the end of 2009, none of these institutions were educating conservation scientists, professionals or technicians. There are no PhD or masters level programs in El Salvador and none seem likely to be established. There are no technician or university level programs in any field of applied conservation. The University Jose Simeon Cañas does offer a master's degree in environment. The program provides students from a variety of disciplines, such as law and medicine, an awareness of environmental issues, but it does not train professionals in the conservation disciplines. Some people have received training on-the-job or in short courses, usually as part of development projects.

Of El Salvador's universities, only the National University of El Salvador has a biology department. Although about 100 students start the program every year, only about 15 students per class graduate per year. The first two years of the program follow a traditional pre-medical course of study, with no study of ecology or any aspect of conservation. Many of the department's professors are graduates of the program itself so they generally do not expose their students to the latest biological knowledge. Ten professors hold a master's degree and no professor has a PhD.

The agricultural programs offered at the University of El Salvador, the National School of Agronomy and several public high schools do not train conservation professionals, technicians or field workers.

Some Salvadorian conservation professionals have studied in other countries. Salvadorian forestry students have mostly studied at the Zamorano Agricultural Training School in Honduras and at the Center for Tropical Agricultural Research and Extension (CATIE) in Costa Rica. A number of biologist have studied at the National University of Costa Rica and the University of Costa Rica. Fisheries management students have generally studied in Chile and the United States.

### **Principal Issues and Priority Actions**

- *Education outside of El Salvador*

The PhD and masters level of conservation education generally produces conservation researchers, leaders and professors. Salvadorians who seek this level of training would have to study outside of El Salvador. The higher costs involved in study outside of El Salvador would in itself be likely to limit the number of people receiving these levels of conservation education. Consequently, it is possible that fewer people than El Salvador requires with these levels of education are studying conservation professions outside of the country.

Without further data and analysis, it is not possible to determine El Salvador's requirements for education in disciplines related to conservation of its biodiversity and forests. USAID/El Salvador could assist El Salvador to determine its educational requirements at the higher levels of the conservation disciplines through a study of its future needs for different types and levels of higher level training in the conservation fields. The study would take one person-month and cost US\$15,000. If the study determines that there is a large gap between El Salvador's need and supply of higher level conservation scientists and professionals then USAID/El Salvador could consider financing a loan or grant program to finance the education of Salvadorians in the field recommended by the study. If the program were to finance ten students for two years each it would cost approximately US\$800,000.

- *Education within El Salvador*

Professionals educated in conservation fields to the bachelor's level in four years usually are those mainly responsible for implementing a country's conservation program. It was not possible for this report to estimate how many people with bachelor degrees in different conservation fields El Salvador has already and how many it will require in the future. Whatever the number may be, it probably would be too expensive to train enough bachelor degree conservation professionals at foreign institutions. El Salvador, therefore, requires its own conservation education programs at the bachelor's level.

Conservation technicians, such as forestry technicians and park guards, implement field activities that require the application of technical skills, including taking instrument readings, inventorying plants and animals, marking timber, and collecting specimens. If it were to establish a field-oriented program of conservation, therefore, El Salvador would require many conservation technicians.

All Salvadorian high school graduates should appreciate the importance of conservation of their country's biodiversity and forests. Therefore, Salvadorian high schools should include a class in conservation in their curriculum. Its curriculum would be a serious course of study, oriented

towards the appreciation of El Salvador's biodiversity and forests and the requirements for using and protecting them. Until now, such a curriculum has not been designed or included in any high school program.<sup>19</sup>

The leaders of municipalities and communities need to be educated in the substance of conservation issues and solutions. Such training should also prepare them for enforcing local ordinances related to conservation of protected areas and watersheds. There are over 262 municipalities in El Salvador, so the scale of this type of training is very large. SalvaNATURA is currently providing a course of nine days in conservation issues for about 100 community leaders per year. It is not assured, however, of additional funding for this training program. USAID/El Salvador could assist El Salvador educational institutions to establish courses in conservation. The first step would be to make a detailed evaluation of the options for conservation education in El Salvador. Three person months of technical assistance for this action would cost US\$45,000. The study might best be combined with that of training needs that was previously recommended. USAID/El Salvador could also finance the sort of training for community and municipal leaders that SalvaNATURA is already carrying out. The estimated budget for such a program would be US\$450,000.

## **6. Institutional Capacity**

### **Justification**

In El Salvador, as in any country, conservation of biodiversity and forests requires an institutional capacity to formulate, implement, monitor and evaluate and adapt conservation actions. The capacity of El Salvador's institutions to carry out these functions, therefore, will be an important factor of the degree to which El Salvador's forests and biodiversity can be preserved.

### **Gaps in the Data**

Few quantitative data were available about El Salvador's conservation institutions upon which to base an evaluation of their capacities for carrying out conservation actions. For example, there were almost no quantitative data available on the qualifications of the staff member, budgets or equipment and infrastructure of El Salvador's public ministries or municipal governments.

### **Status**

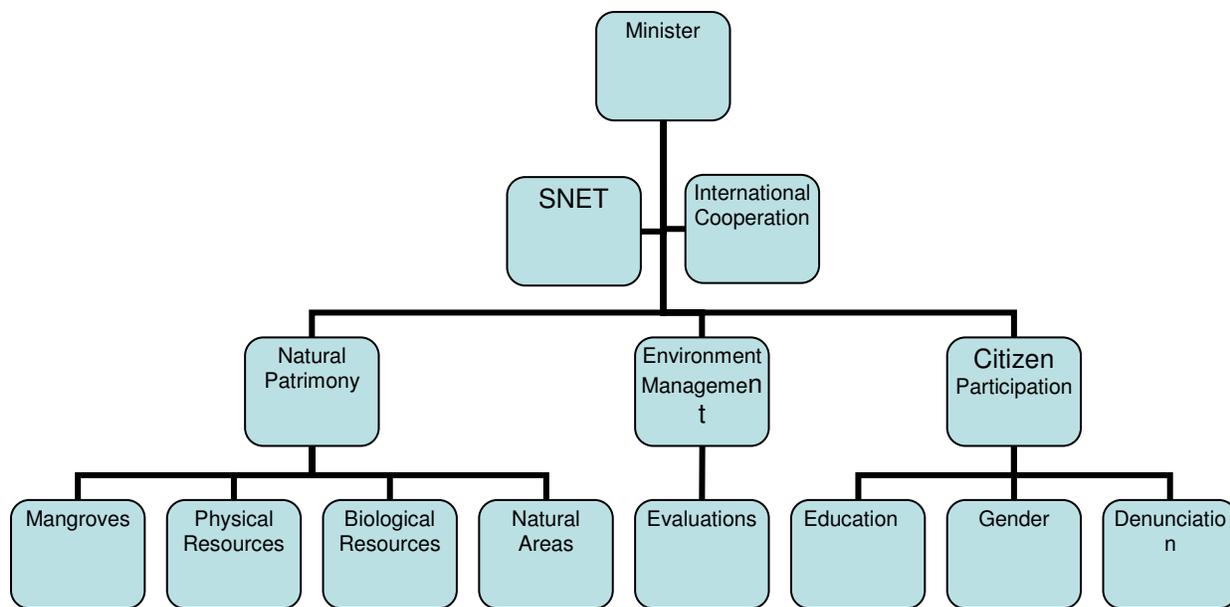
The Ministry of Environment and Natural Resources (MARN), the Ministry of Agriculture and Livestock (MAG), the Ministry of Tourism (MITUR), municipal government, environmental NGOs, Associations for Community Development (ADESCO) and private enterprises are the principal institutions or types of institutions that have responsibilities for conservation in El Salvador. The following sections summarize the status of these institutions.

- *Ministry of Environment and Natural Resources (MARN)*

MARN, created in 1997 by an executive decree, is the public institution with national responsibility for conserving El Salvador's forests and biodiversity. Figure 2 shows the parts of MARN's institutional structure that have most directly to do with the conservation of biodiversity and protected areas.

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<sup>19</sup> The textbook Natural History and Ecology of El Salvador, published by the Ministry of Education in 1995, was such a textbook but it is now out-of-print and out-of-date.



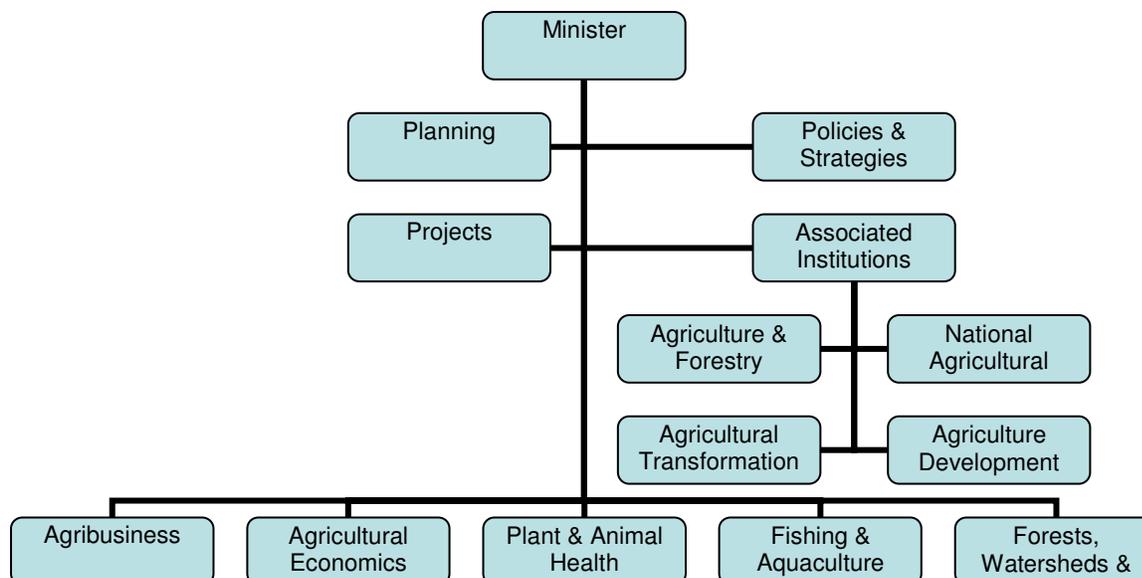
**Figure 2. Organization of the Ministry of Environment and Natural Resources**

In the first box on the left, below the minister, the initials SNET stand for the National Service for Territorial Strategies. It collects, organizes, analyzes and publishes data on El Salvador's climate and water bodies, particularly for the purpose of predicting natural disasters. On the right, the Office of International Cooperation is important because MARN receives such a large portion of its funds from international organizations.

MARN's operational level has three General Directorates. The General Direction of Natural Patrimony (DGPN) has the most functions. It is directly responsible for the National System of Protected Areas (SANP) and for fomenting conservation activities in the other conservation designations, such as Conservation Areas, Ramsar sites, and Biosphere Reserves. DGPN has a staff of 84, of whom 63 are professionals, most of them with degrees in general biology or agronomy. The General Direction of Environmental Management is responsible for approving the terms of reference for environmental assessments and then the environmental assessments themselves. The General Direction for Citizen Participation is responsible for environmental education programs, for incorporating gender considerations into MARN's activities and for receiving and acting on denunciations from the general public regarding threats to the environment.

- *Ministry of Agriculture and Livestock*

The Ministry of Agriculture and Livestock (MAG) is a large and powerful ministry in El Salvador, reflecting the country's long dependence on agricultural exports, especially coffee, for economic prosperity and growth. Although El Salvador no longer is so dependent on agriculture, MAG remains a larger and more powerful institution by far than the Ministry of Environment. Figure 3 shows MAG's institutional structure.



**Figure 3 Institutional structure of the Ministry of Agriculture and Livestock**

Figure 3 demonstrates that many different parts of MAG have responsibilities for establishing plans, policies, strategies, and projects actions that are likely to directly or indirectly affect El Salvador's biodiversity and forests. The directorate in MAG that has most direct responsibility for activities that affect biodiversity and forest, however, is the General Directorate of Forestry, Watersheds and Irrigation (DGFWI), which is supposed to take responsibility for public sector activities that are related to El Salvador's forests and for the management of its watersheds.

Forestry is not an autonomous department within the DGFWI. The DGFWI has no power to take operational or policy decisions, which are taken at the level of the minister. The members of the forestry area staff are mostly concerned with enforcing regulations governing the cutting of trees and the transport of forest products. The forestry department has a central office in the outskirts of San Salvador and five regional offices. The DGFWI's budget covers the costs of salaries and operating expenses but does not include sufficient funds to permit it to implement any field projects. According to its director general, DGFWI carries out no watershed management activities at all.

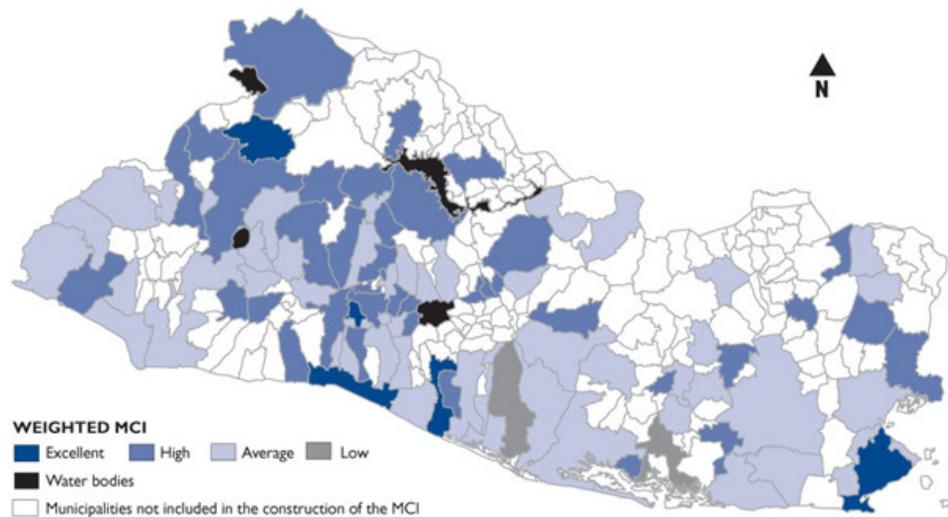
- *Ministry of Tourism and the Salvadorian Tourism Corporation*

The Ministry of Tourism (MITUR) and the Salvadorian Tourism Corporation (CORSATUR) promote tourism to and in El Salvador. The Law of Tourism mentions El Salvador's natural patrimony as one of its attractions for tourists. The web site of these institutions provides no information about their organizational structure, staff, or budgets.

The policies and actions of MITUR and CORSATUR will influence the condition of El Salvador's biodiversity and forests. The protected areas are already a tourist attraction and they could become more important. MITUR and CORSATUR, therefore, should be concerned about the condition of the protected areas. Their promotion of El Salvador as a destination for tourists will lose credibility if the SANP does not live up to their promotion leaving a negative impression of El Salvador's seriousness as a country.

- *Municipal Governments*

The municipal governments in El Salvador have considerable power over land use decisions at the local level. It was not possible for this report to make a first-hand evaluation of the capacities of El Salvador's municipal governments. Recently, however, a Municipal Competitiveness Index (MCI), was prepared recently for some of El Salvador's municipalities. The MCI found that Salvadoran municipalities vary greatly in their attractiveness as places for profitable investments. The municipalities colored in dark blue on Map 8 are the highly competitive municipalities. The municipalities colored in lighter blue or gray are less competitive. In part, these differences reflect the competence of municipal governments. Competent municipal governments presumably are better able to plan and implement conservation actions, such as the protection and management of the smaller components of the SANP. (<http://www.indicemunicipalelsalvador.com>, 2009)



**Map 10 Competitiveness indexes of El Salvadorian municipalities**

Salvadorian law requires each municipality to have an environmental unit. It was not possible to obtain data on the number and condition of the environmental units. Interviews in the MARN, however, indicated that some municipalities have not yet established environmental units and that that most environmental units are not well-funded or staffed. Furthermore, the primary function of most municipal environmental units has been urban concerns such as the collection of solid waste, rather than land use planning or conservation of forests and biodiversity. The municipal environmental units are an important local governmental structure, however, and in some municipalities their responsibilities could be expanded to include actions related to the conservation of biodiversity and forests.

- *Conservation NGOs and Community Development Associations*

A number of conservation NGOs and Local Community Associations (ADESCOs) have assumed direct responsibility for the protection and management of the protected areas that are components of the SANP. Many of them have received funding from the Fund of the Americas for El Salvador (FIAES). In 2008 the Salvadorian consulting company SERTECNIA prepared the document "Impact Evaluation of the Projects Financed by the FIAES in the Period". Table 19 is taken from this report. It lists the organizations that received funding from FIAES between 1994 and 2006. Since it contains only those NGOs and ADESCOs that received FIAES funding

this list may not include all of El Salvador's NGOs and ADESCOs that have been involved in conservation activities.

**Table 19 List of principal NGOs and ASDECOS supported by FIAES between 1994 and 2006**

<b>Acronym</b>	<b>Name</b>
<b>Health Associations (6)</b>	
ASAPROSAR	Salvadorian Association Pro-Rural Health
ALFDALIT	Christian Association for Education and Development
AGAPE	Agape Association of El Salvador
APSSIES	Association for Health and Inter-Community Social Service in El Salvador
ASPS	Promoting Health Salvadorian Association
MADRECRÍA	Madrecría Association
<b>Community Development Associations (21)</b>	
ADESCOLAB	La Barra Neighborhood Community Development Association
ADESCOJUPAM	Community Development Association Together to Improve
ADHU	Association for Human Development
ADESCOBN	Nancuchiname Forest Community Development Association
ADESCIE	Ignacio Ellacuria Community Development Association
ASACMA	Salvadorian Association of Environmental Conservation
AMBAS	Bara de Santiago Women Association
AMS	Association for Self-Determination and Salvadoran Women Development
ADESCOCA	El Cacahuatique Community Development Association
ADEL OAT	Local Economic Development Agency/Support Office to Labor of North Area of San Salvador Department
ADESCONE	Nueva Esperanza Community Development Association
ADESCOP	Fishery Community Development Association Metapan Lagoon
CODECA	Coordinator of Communities for Development of the Cacahuatique
ADESCOIM	Mendez Island Community Development Association
BALSAMO	El Balsamo Association
FMG	Manuael Gallardo Foundation
FUNDESA	Foundation for Development
CENCITA	Entire Cooperation Center on Alternative Technologies
FIE	Ignacio Ellacuria Foundation
MSM	Salvadoran Movement of Women
PADECOMS	Association Patronage for the Communities Development of Morazan and San Miguel
<b>Conservation Associations (7)</b>	
AAVSS	Friends of San Salvador's Volcano Association
Asociación Mangle	Mangle Local Association for Disaster Mitigation and Development of Low Lempa and Jiquilisco Bay
CEPRODE	Protection Center for Disasters
FUNDARRECIFE	Los Cobanos Reef's Neighbor's Foundation
FUTECMA	Teclena Pro-Environmental Foundation
FUNSADECA	Santaneca Foundation for Community and Environmental Development
FUNZEL	Zoological National Foundation El Salvador
SALVANATURA	El Salvador Ecological Foundation

Source: SERTECNIA, (2009)

Table 19 indicates that of the 33 organizations which received grants from FIAES between 1994 and 2006, six were health or women organizations, 21 were community development organizations and seven are conservation organizations.

Although part of FIAES's mission statement is "...the strengthening of executing organizations...", the SERTECNIA evaluation did not evaluate if FIAES support has strengthened the organizations listed in Table 19 (SERTECNI, 2009). Nor has any other report, so far as could be determined. According to the Executive Director of FIAES, however, FIAES has established strict requirements for winning a grant from FIAES and they have forced these organizations to become legally incorporated and improve their administrative and accounting capabilities (J. Oviedo, pers. com., 2009).

SalvaNatura and FUNZEL are two Salvadorian environmental NGOs that currently play a particularly important role in the conservation of El Salvador's biodiversity. FUNZEL is an organization dedicated to conservation of wildlife. Its mission statement is "promote the conservation and sustainable use of the wildlife of El Salvador by means proposing and implementing wildlife management programs, research, education and environmental management, oriented towards generating changes in attitude among the different sectors of the population and improving the decision making process". FUNZEL has a long history of implementing a variety of conservation projects, but it has concentrated on rescuing and caring for illegally captured animals of rarer species. With USAID/El Salvador funding, the IMCCW is helping FUNZEL to become a stronger institution so that it can be the lead Salvadorian NGO for a national strategy for conserving sea turtles. SalvaNATURA is El Salvador's largest environmental NGO and MARN has assigned it direct responsibility for the management of two national public protected natural areas.

- *Associations for Community Development*

Associations for Community Development (ADESCOs) are not primarily conservation associations but are organized within municipalities for the purpose of promoting local development. FIAES, however, has provided grants to a number of ADESCOs, to permit them to manage small, protected areas. Since the ADESCOs represent local people, they sometimes become involved in local conflicts over access to natural resources. They have an important role to play in the resolution of conflicts over access to natural resources, including the use of protected areas. However, although they have closer links to local people than most NGOs, generally ADESCOs tend to be weaker of the two types of institutions (Oveida, J., per. com., 2009)

- *Private landowners*

Most land in El Salvador is privately owned. Thus private landowners have an important role to play in the conservation of its biodiversity and forests. The Law of Protected Areas includes the category of private protected areas but does not indicate exactly their status or relationship to the rest of the SANP (Barborak, 2003). The Association of Proprietors of Private Natural Reserves of El Salvador (RENAPES) was formed in 2003. Its objective is to establish a network of private landowners in El Salvador which will support the effective functioning of the SANP and the biological corridors that should connect its component parts. RENAPES is creating alliances with national government entities such as the Ministry of Environment and Natural Resources (MARN), the Ministry of Agriculture and Livestock (MAG) and the Ministry of Tourism (MITUR) and with municipal governments. RENAPES is looking for financing for its members to carry out conservation measures through payments for ecosystem services and through donations from international aid institutions. RENAPES is a member of the Central American

Network of Private Reserves. Barborak (2003) recommends measures to encourage private protected areas, such as establishing clear policies, criteria and regulations for their establishment and management.

### **Principal Issues and Priority Actions**

- *Municipal administration of small protected areas*

The General Directorate of Natural Patrimony (DGPN) cannot administer adequately the 53 public protected areas that now form SANP, let alone give its attention to its private and municipal components. Yet if all the pending areas were to be legalized as part of SANP it would have 165 areas, three times as many as now. In order for the DGPN to concentrate its limited resources on El Salvador's eight most important protected areas, it needs to pass control over the smaller areas in SANP to the municipal governments.

Transferring the small protected areas municipal government involves a long and complicated administrative process. Under the category of conservation action of protected areas above, this report recommends support to ISTA and MARN for completing the process of legalizing the 89 pending areas that were reserved for protected areas under the 1980 land reform. A related priority action is to support the municipal governments who would assume administrative responsibility for most of these areas. The estimated cost for this priority action is US\$500,000.

- *National Public Institutional Roles and Responsibilities for Conservation*

At the national level, three public institutions share responsibility for conserving El Salvador's biodiversity and forests: the Ministry of Environment and Natural Resources (MARN), the Ministry of Agriculture and Livestock (MAG) and the Ministry of Tourism (MITUR). Successful conservation in El Salvador requires that these three institutions define their respective roles for conservation actions and then coordinate their actions effectively between themselves. If MAG's policies for agriculture and livestock, for example, encourage an expansion of cropland and pasture, rather than an increase in yield on existing cropland and pasture, they could stimulate the clearing of secondary forest, negatively affecting biodiversity and the condition of watersheds. If MITUR's promotion of El Salvador increases tourism to protected areas, without them being prepared for more visitors, their habitat and organism could be harmed. If MARN does not prepare for more visitors, on the other hand, it could lose income from park fees that could finance conservation activities. There are many more examples of how these ministries inter-act to affect El Salvador's biodiversity and forests.

Immersed as they are in their day-to-day activities, it may be difficult for the leaders of MARN, MAG and MITUR to identify the multiple links between their organizations in relation to the conservation of El Salvador's biodiversity and forests. An external expert in institutional structures and functions could, therefore, provide them with useful assistance. The expert could lead a task force of staff members from the three institutions that would analyze the current and potential roles of these institutions for conservation of biodiversity and forests and recommend specific mechanisms for increasing inter-ministerial coordination and collaboration. This technical assistance would require three person-months at a cost of about US\$45,000.

- *Private land and conservation of biodiversity*

Since most of El Salvador's land is in private ownership, conservation on private land is particularly important for the conservation of El Salvador's biodiversity and forests. Yet private land owners in El Salvador have received little support for their conservation actions. Through RENAPES, USAID/El Salvador could help to expand and strengthen the participation of private

landowners in Salvadorian conservation. Support might be provided in the amount of about US\$220,000.

## **7. Conflict Resolution and Land Use Planning**

### **Justification**

Conservation of El Salvador's biodiversity and tropical forests requires effective planning and regulation of the uses of the country's terrestrial and marine territory, as part of conflict resolution processes. Otherwise, El Salvador's territory is potentially open to unregulated and unplanned changes in land use. If such changes were to include elimination or degradation of the small remaining areas of climax forest habitats the effects on El Salvador's biodiversity would be devastating. Territorial use planning and regulation and effective conflict resolution processes, moreover, would strengthen El Salvador's democracy and economy.

### **Gaps in the Data**

Time limitations did not permit the authors of this report to discuss conflict resolution and regulation of the use of territories with any representatives of the Salvadorian institutions, such as ministries and municipalities that are responsible for regulation of use of terrestrial and marine territories. No quantitative data were available on the number of conflicts over territories and access to natural resources that occur in El Salvador. Nor was information available on the character of such conflicts.

### **Status**

Before 1999, decisions about the location of investments affecting land use were taken with little or no technical criteria. By 1999, however, officials in the Ministry of Public Works and the MARN had come to realize that El Salvador's disorderly development of land was seriously restraining economic growth by wasting money on designing projects that were unfeasible due to the environmental characteristics of the proposed building sites. Similarly, officials in the Ministry of Public Works and owners of private businesses had come to realize that the failure to plan San Salvador's road network was exacting a huge economic cost through the time and fuel people were losing through traffic jams. Government officials also realized that lack of land use planning and regulation had raised both the cost and likelihood of natural disasters. For all these reasons, it had become clear that an effective land use planning and regulation process would make environmental, financial and economic sense.

A draft of a land use planning and regulation policy and a draft of law were prepared between 2004 and 2005. They were presented to the National Assembly at the end of January 2008. President Saca recognized the importance of this law saying, "We must put a stop to the disorder in the constructions and try to optimize our resources through the passage of the land use planning and regulation law" (El Faro Net, 2009). In 2009 the Municipal Affairs Committee of the National Assembly sent a draft Law of Planning and Territorial Development to the full National Assembly. The law, however, raises serious issues regarding the control of the government over the actions of the private sector in El Salvador, which has not been accustomed to much government oversight in relation to land use. Consequently, the assembly returned the draft law to the committee for further consideration (El Diario de Hoy, 2009).

### **Principal Issues and Priority Actions**

- *Conflict resolution and land use planning*

Conflict over land use and access to natural resources is pervasive in El Salvador. To establish conflict resolution processes, therefore, will require a determined, systematic, technically sound, long-term effort. Neither MARN nor the municipalities, however, have staff members who have training and experience in conflict resolution practices. Nor does MARN currently have a plan for systematically using conflict resolution practices to resolve conflicts over access to natural resources. In order to implement successfully a conflict resolution strategy, MARN and the municipalities will need people who have been trained in specific conflict resolution techniques. If 40 people were trained at a cost of US\$500 per person, the total cost would be US\$20,000. It is conceivable that Minister Rosas, who believes that land use planning and conflict resolution are El Salvador's principal requirement for conserving its environment, would be interested in support from USAID for other activities of MARN related to land use planning and conflict resolution. USAID/El Salvador for his initiative with about US\$100,000 could yield tremendous returns for the conservation of El Salvador's biodiversity and forests.

## **8. Public Support for Conservation**

### **Justification**

In a democracy, the opinions of citizens influence the decisions that leaders take regarding policies and actions. Thus programs that effectively communicate conservation problems, issues and solutions to different segments of El Salvador's society, such as business leaders, educators, students, workers and farmers, will increase their understanding and support for and reduce their opposition to conservation measures. Citizens will then communicate that understanding and support to their leaders, who will then be more likely to devote effort to formulating sound conservation policies and find financing for conservation actions.

### **Gaps in the Data**

No data were available on the attitudes towards conservation issues of different segments of the Salvadorian populations, segmented by age, occupation, economic status, or location.

### **Status**

During the 1990's the GreenCOM project, financed by USAID, assisted the Ministry of Education to incorporate environmental topics into the grade and high school curriculums, prepare training materials, and train teachers in how to teach environmental material to children. The Salvadorian curriculum still contains an environmental component, although many of the teachers who were trained have now retired and the teaching materials have been depleted. Through the Improved Management of Critical Watersheds Project USAID communicated conservation information to 22,000 rural people (Kernan, 2009). Currently, environmental communication in El Salvador is mostly being implemented by environmental NGOs at the local level in connection with the projects that FIAES finances. SalvaNATURA is the only NGO active at the national level in environmental communication, through the publication of its magazine.

The National Zoo, the National Museum of Natural History and the Botanical Garden La Laguna (a private institution) could communicate conservation issues to the hundreds of thousands of people who visit them every year. The National Zoo alone receives over half a million visits every year (Miranda, R., per. com., 2009). Currently, however, most Salvadorians probably attach no or little value to the conservation of biodiversity and forests. Their leaders, therefore, give relatively little importance to conservation, which is reflected in MARN's small budget and the poor status of the national protected areas.

## **Principal Issues and Priority Actions**

- *Conservation communication*

There are many environmental problems in El Salvador about which the general public and decision makers should know more than they currently do. El Salvador, however, has a clear conservation priority – the protection and management of the eight areas listed in Table 6 that contain most of its threatened and endangered species of plants and animals. El Salvador's citizens need to understand the character and importance of these areas so that they support the actions of government and private institutions to conserve their forests and biodiversity.

El Salvador thus needs a communication program that would raise the level of support among Salvadorian citizens for the actions required to conserve and expand its eight most important protected areas. Although the program should become a permanent part of MARN's activities and should communicate specific information on the character, threats, solutions and values of the protected areas, it should be designed to immediately and drastically change the attitudes and perceptions of many Salvadorians towards their eight priority conservation areas. The design of the program would require one person month at a cost of US\$15,000. The program itself should last two years and cost US\$360,000.

### **9. Financial Incentives for Conservation**

#### **Justification**

The potential or not for personal financial gain exerts a powerful influence on most people's decisions including those that influence the conservation of biodiversity and forests. By aligning positive financial incentives with conservation objectives, therefore, it may at times be possible to provide the incentives the private sector requires to take conservation actions.

#### **Gaps in the Data**

For this study, there was insufficient time to thoroughly analyze the different possibilities in El Salvador for increasing the financial incentives for conservation or for analyzing the potential financial returns from such actions.

#### **Status**

Financial incentives already are contributing to the conservation of forests and biodiversity in El Salvador: through tourism, forest management and the production of commercial wildlife. Forestry for the production of forest products has long been a proven method for establishing financial incentives for conservation. Serious forest product businesses have an obvious incentive for conserving the resources they require to continue to operate. In El Salvador, however, there are few examples of management of natural forest. Those that do exist suffer from excessive regulations that add to their transaction and operational costs, thus reducing their financial incentive for forest management.

Tree plantations in El Salvador have the potential to produce large volumes of uniform quality and species of lumber. Tree plantations, however, do not create the habitat required by El Salvador's rarer species of organisms. Their immediate value for the conservation of biodiversity is, therefore, limited. Tree plantations can, however, produce two longer-term conservation benefits. Their production of large volumes of timber may reduce the pressure to degrade natural forests through haphazard, non-technical logging. They may also restore soil structure and fertility to eroded sites, thus eventually establishing the site conditions required for

the regeneration of native species of vegetation and the re-establishment of the habitat that species of rarer organisms require.

Forests can also produce non-wood products, such as wildlife and plants with commercial value. Their production from natural habitat, however, is usually too low to provide much financial incentive for the conservation of forests and biodiversity. Iguanas, for example, have a strong market, but they are not hunted in the wild but grown on farms. Similarly, ferns, butterflies, deer, plants, fungi, algae and protozoa are products that occur in natural habitats but whose commercial production does not depend on wild populations but on more intensive production under controlled conditions.

By contrast, wild production of commercial organisms does occur in aquatic ecosystems. The most obvious examples are the many species of fresh-water and marine fish and other seafood that are caught in the wild for commercial purposes. El Salvador has a fishing industry upon which many people depend. The industry, however, has depleted rather than conserved the stocks of many species of marine fish, probably because the rights to the fish in a certain area are not limited to an individual or group of individuals. The financial incentive, therefore, is not to conserve the fish stocks but to exploit them as fast as possible. Conservation of fish has occurred when specific people have been assigned exclusive control over certain fishing areas, as has been done in some parts of the Bahia de Jiquilisco.

Until early 2009, many wild marine turtle eggs were collected on the beaches of El Salvador and sold for food. Recently the national government declared the collection and consumption of marine turtle eggs illegal. In order to replace the income from the sale of turtle eggs, the Improved Management of Critical Watersheds Project, financed by USAID, and several other projects as well, are purchasing turtle eggs, incubating them, and releasing the baby turtles into the ocean. They are thus creating a market for turtle eggs that is based entirely on the conservation objective of increasing the number of marine turtles, not upon a consumptive use of turtle eggs. This market, however, depends on external financing for the purchase of the turtle eggs. The source of funds for continuing the purchase of large number of eggs after IMCW has not been determined (see Success Story 2).

Other than some visits to archeological sites, most of El Salvador's tourism industry is based on visits to natural areas, a non-consumptive use of natural landscapes. Animals, especially birds, are almost always of interest to tourists. Nature tourism could contribute to the conservation of threatened and endangered species by providing income for protected areas.

### **Principal Issues and Priority Actions**

- *Exclusive rights to exploitation*

When exploitation of wild species is permitted, exclusive rights to them must be assigned to an individual or group of people or it is almost certain that there will be no financial incentive for conservation. Consequently, the species will be over-exploited until its population becomes so small as to be no longer of commercial interest. El Salvador has declared areas outside of protected areas, such as Conservation Areas, Ramsar Sites, and Biosphere Reserves, where exploitation of wild species is permitted. To conserve these species, exclusive rights to their exploitation must be assigned to individuals or groups of people.

To establish exclusive rights within defined geographic zones, particularly for marine and estuary species requires an evaluation of how well the current projects that have assigned exclusive rights have functioned, particularly as a means of conserving threatened or endangered species. Such an evaluation would require about three months of technical assistance and cost approximately US\$45,000. On the basis of the evaluation, additional steps could be determined to assign exclusive rights.

## **10. Financing for Conservation**

### **Justification**

Effective conservation of El Salvador's biodiversity and forests is a long-term, systematic endeavor. To achieve specific conservation objectives requires adequate and permanent levels of financing. Only with the assurance of sufficient, long-term financing will Salvadorian public and private conservation institutions be able to carry out conservation activities systematically and according to pre-established long-term conservation objectives. Conservation institutions will not be able to achieve the conservation of El Salvador's threatened and endangered forests and biodiversity unless they are assured sufficient, stable financing.

### **Gaps in the Data**

Lack of access to data did not permit a detailed, quantitative analysis of the financing being made available for conserving El Salvador's forests and biodiversity from different possible sources. Even basic financial data, such as the budgets for the principal conservation institutions in El Salvador (MARN, GDFWI, and the National Fund for the Environment in El Salvador) were not available.<sup>20</sup> The current and future financing for conservation in El Salvador planned by international organizations were also not available.

### **Status**

The principal institutions and organizations that require funding to implement conservation actions in El Salvador are (1) national and local governments; (2) international donors; (3) environmental funds; (4) private businesses; and (5) private non-profit environmental organizations.

- *National government*

The two Salvadorian national public institutions with legal responsibilities for conservation actions clearly are underfinanced. The Director General of the Directorate of Natural Patrimony in MARN, the Director General of the Directorate of Forestry, Watersheds and Irrigation in the Ministry of Agriculture and Livestock and the President of the Institute for Agrarian Reform (ISTA) all indicated that the government budget allocates their institutions only the funds required to pay salaries and operating expenses. They also indicated that international aid projects finance almost all their field project or other non-routine activities, such as studies and international meetings, and that their institutions lack sufficient equipment, such as vehicles, for field operations. Other public institutions with important roles in conservation, including the National Zoo, the National Herbarium and the University of El Salvador, also noted their low level of funding.

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<sup>20</sup> El Salvador's national government scored the low score of 37 percent on the Open Budget Index, indicating that it provides the public with minimal information on the central government's budget and financial activities. Access to the highly detailed budget information needed to understand the government's progress in undertaking a specific project or activity remains limited. This is despite the fact that El Salvador's Constitution includes the right to petition. ([http://openbudgetindex.org/files/cs\\_elsalvador.pdf](http://openbudgetindex.org/files/cs_elsalvador.pdf), 2010)

The management of the SANP is the principal responsibility of the DGPN, although it has passed direct responsibility for many of the individual areas to conservation NGOs and ADESCOs.. According to SalvaNATURA an adequate budget for El Imposible National Park, including the payment of 25 park guards, would be US\$180,000 (Barborak, J.R., 2003). El Imposible has 3,700 ha, so this total cost would be a cost per hectare is US\$49. If the total area of the SANP is 70,583 ha, then at a cost of US\$49 per hectares, its total annual budget should be US\$3,458,000. If SANP's total area is less than 70,583 ha, and the cost per ha is less than US\$49 per hectare, then the required annual budget for SANP would be something less than US\$3,458,000. In any case, in 2009, the funds from the national budget allocated to the DGPN were less than US\$100,000 (Quezada, J., which amounts to only US\$1.41 per hectare. If the cost per hectare to manage a protected area is US\$49 per hectare, the annual cost of managing the 14,133 ha in the eight protected areas listed as priorities in Table 11 would be US\$692,517. Even that amount is seven times more than the DGPN's funding in 2009.

These are rough calculations of the cost of managing protected areas, since the actual per hectare cost of managing individual protected areas would of course vary depending on their size, location, ease of access and other factors. It is likely, for example, that the cost per hectare of managing a smaller protected area would be higher than that of managing a larger protected area. In any case, the management plans for each protected area should make an accurate calculation of its operating and investments costs. These calculations, however, although no exact make it clear that El Salvador has declared national natural protected areas and assigned responsibilities to the DGPN for their protection and management without allocating it the financial resources required to comply with those responsibilities.

- *Municipal Governments*

Certain of the legal responsibilities of Salvadorian municipal governments give them considerable influence of land use planning and regulation and, therefore, over land use. Land use, of course, determines the extent and quality of habitat for wild plants and animals. Municipal governments are more accessible, so they tend to respond more quickly to the concerns and complaints of local people. Work and water almost always are important local concerns. Protected areas within a municipality thus become a concern of local government because they may protect the supplies of municipal water supplies<sup>21</sup> and they may offer an opportunity for tourism enterprises, thereby creating jobs. Salvadorian law requires municipalities to create Environmental Units, which would logically be assigned responsibility for ensuring the protection of the vegetation in watersheds. Sometimes these watersheds are within a protected area<sup>22</sup>

Salvadorian municipalities, as discussed previously, vary greatly in their financial resources and administrative capabilities. The richer and capable municipalities would have greater possibilities of financing conservation than the poorer and less capable ones. A detailed

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<sup>21</sup> It is not true that forested watersheds necessarily provide more water than non-forested watershed, since trees drive the process of evapotranspiration, by which water is drawn out of the ground, up through the tree and released through the leaves into the atmosphere.

<sup>22</sup> Over the last two decades, USAID/El Salvador and other institutions have financed a series of watershed management projects in the El Imposible- Barra de Santiago watershed. □ Their outreach programs have created understanding and appreciation among local people of how protecting forests in watersheds protects the quality and reliability of their water supplies. They have also promoted the formation of local Water Boards (Juntas de Agua). Two Juntas de Agua in the Barra de Santiago-El Imposible watershed paid the salaries of three park guards who worked under the administration of SalvaNATURA (Baborak, J.R., 2003). In 2010, SalvaNATURA was receiving a small donation every month from two Juntas de Agua, but the fund only covers the cost of one park guard. It is planning on meeting with them and other users of water soon to negotiate more support (Komar, O., per.com., 2010).

discussion of municipal finances is beyond the scope of this report. However, in other parts of Latin America, municipal governments have established fees as a percentage of water consumption which are used for the protection of watersheds, including the protected areas that are located within the watershed. There are many advantages to this method of raising funds for conservation: the fee payers can monitor the use of the funds; no single decision can eliminate the funds; the financing is more reliable than yearly allocations. No Salvadorian municipality has yet established fees for water use and used the income for conservation. The potential of this mechanism for raising funds for conservation makes it a priority conservation action in El Salvador.<sup>23</sup> Salvadorian municipalities, however, probably require assistance in order to establish such fee systems. An estimated budget for providing such assistance to one or more Salvadorian municipalities is US\$90,000.

- *International donors*

International organizations that have funded conservation activities in El Salvador include the World Bank, FAO, UNDP, the and the Inter-American Development Bank. Bi-lateral aid organizations that are financing conservation projects in El Salvador currently are USAID, Spanish Technical Cooperation and the GTZ.

The only international environmental NGOs that is currently financing conservation activities in El Salvador currently are the International Union for the Conservation of Nature (IUCN). The World Wildlife Fund, Conservation International, and the Nature Conservancy do not have activities in El Salvador currently. The Central America Tropical Research Organization (CATIE) generally has some conservation activity going on in El Salvador, as components of Central American regional projects.

- *Environmental funds*

An important source of financing for conservation in El Salvador has been the Initiative for the Americas Fund (FIAES). FIAES was established in 1993 with funds from a debt-swap with the U.S. Government and from the U.S. Tropical Forest Initiative. FIAES has the mission of “financing environmental improvement projects which contribute to local sustainable development through the strengthening of executing organizations, with the ultimate goal of contributing to the improvement of the living conditions of Salvadorian communities”.

Through 2006 FIAES had invested US\$44,953,911 and its counterpart organizations US\$8,400,795 in 811 projects. FIAES financed projects in the following areas: (1) Hydrographical Micro-Basins and Continental Aquatic Ecosystems, (2) Natural Protected Areas, Buffer Zones and Coastal Marine Ecosystems; (2); Water; (3) Soil and Air Decontamination; (4) Children Survival and Progress; and (5) Applied Research. All of these projects included the transversal elements of community participation and development, gender equality, environmental education, solid waste management and socio-environmental risk mitigation. Table 20 indicates the distribution of FIAES investments between these areas.

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<sup>23</sup> In 2005, the World Bank prepared a project appraisal document for a loan for US\$5 million and a grant from the Global Environmental Facility Trust Fund for another US\$5 million for a project that was called the Environmental Services Project (World Bank, 2005).. Evidently, this project was never financed for reasons that this were not determined for this report.

**Table 20 Investments of FIAES funds by strategic area 1994 - 2006**

Strategic Areas	Number of Projects	Investment US\$	Percentage
Natural areas, buffer zones & coastal marine ecosystems	232	14,514,122	24
Hydrographic micro basins & aquatic ecosystems	376	24,763,444	43
Water, soil and air decontamination	87	5,768,880	11
Children survival and progress	53	3,609,737	8
Applied research	48	4,339,114	13
Emergency	15	359,408	1
<b>TOTAL</b>	<b>811</b>	<b>53,354,706</b>	<b>100</b>

Source: SERTECNIA, 2008

Of the US\$45 million dollars disbursed for these projects, US\$ 12.45 million financed activities in 51 protected natural areas. Much of these funds were used to pay park wardens (SERTECNIA, 2008).

FIAES is such an important source of financing for conservation in El Salvador that how it chooses to assign its funds will greatly influence conservation in El Salvador. Barborak (no date) recommended that FIAES's revise its system for assigning funds so as to assign funds directly for SANP, thus ensuring that it receives sufficient, regular financing for its priority areas and providing to priority conservation activities. Rather than distribute its funds over a large number of small protected areas and organizations, in other words, FIAES would achieve more conservation results by concentrating its funding on the eight priority protected areas. The technical director of SalvaNATURA similarly recommended that FIAES extend the maximum time of its grants to more than two years and permit a larger NGO which manages several large protected areas, such as SalvaNATURA, to receive more than the current limit of US\$100,000 per year (Komar, O., per. com., 2009).

MARN manages the National Fund for the Environment of El Salvador (FONAES) which was started in 1994 with funds from a debt-swap arranged by the Government of Canada. Its main objective is to strengthen community level environmental organizations and to foment inter-institutional coordination. FONAES is financing a network of 25 municipal environmental units and a environmental education program for teenagers called "Environmental Guards" (<http://www.fonaes.gob.sv>) The amount of the FONAES was not determined.

- *Private sector for-profit organizations*

Salvadorian private sector, for-profit organizations sometimes have financed conservation actions in El Salvador through direct donations to conservation NGOs. Citibank, for example, occasionally has provided financial support to SalvaNATURA. MARN also sometimes requires for-profit companies to finance environmental activities in compensation for the adverse effects of their projects or activities. El Salvadorian enterprises which are based on forests and biodiversity also finance conservation actions. Coffee-farmers, for example, have invested over \$800,000 in conservation measures in order to attain certification for their product (Kernan, 2009). Several butterfly farms, likewise, have made investments in the production of rare species of butterflies. Wood industries have invested in forest tree plantations and ecotourism businesses have financed the protection of natural areas within or near their operations. Some owners of private land are financing conservation actions on their land. It was beyond the

scope of this report to obtain more detailed information about the amount of funds El Salvador's private sector is contributing to the conservation of the country's biodiversity and forests. The contribution of the private sector to conservation in El Salvador, however, should not be discounted or ignored since overall it could be larger and more effective than many other types of conservation actions.

- *Environmental non-government organizations*

Private non-profit conservation organizations in El Salvador raise money to finance their own operations and projects through donations and by receiving grants from international aid organizations. One indication of this lack of financing is that of the 19 environmental NGOs which received assistance from USAID between 1993 and 1995 under the Environmental NGO Institutional Strengthening Project (FOPRAS) only seven still existed in 2004 (Catterson, T. et al., 2004) and even fewer in 2009.

SalvaNATURA has been the most successful of the Salvadorian conservation NGOs in raising money from private business as well as international donors and environmental NGOs, although it lacks any permanent source of financing and must constantly look for funds to finance its various programs (Barborak, J.R., 2003; Omar, O., per. com., 2009). Even it, however, does not have enough financing. Its technical director estimates, for example, that its conservation training program for municipal and community leaders should be funded at a level of \$250,000 per year in order to meet El Salvador's needs for such training. But in 2009 the program's budget was only US\$127,000. The technical director also notes that SalvaNATURA's annual budget for the four protected areas which it manages should be between US\$400,000 and US\$500,000. During 2009, however, SalvaNATURA received funding of only US\$180,000. Although a detailed analysis was not possible, the indications are that the level and reliability of financing is less than would be optimal for Salvadorian conservation NGOs to carry out dynamic and effective conservation activities on the scale required in El Salvador to conserve its biodiversity.

Tables 21 and 22 list most of the projects for which SalvaNATURA and FUNZEL have received funding since 1992. The tables indicate that both SalvaNATURA and FUNZEL have a wide range of activities and have been able to obtain funds from a number of different sources. This ability is an indication of their strength as institutions. It also suggests, however, that they have to devote a considerable amount of their time to raising funds, suggesting that this time may be subtracted from that available for the design, supervision and evaluation of the conservation work in the field that El Salvador requires to conserve its forests and biodiversity.

**Table 21 Sources of financing for SalvaNATURA**

<b>Projects</b>	<b>Financing Source</b>	<b>Budget/Yr (US\$)<sup>24</sup></b>
El Imposible National Park	FIAES, entry fees, Philip Morris Inc., Gran Ducado de Luxemburgo, local water boards, others.	150,000
Los Volcanes National Park	Grupo Roble, entry fees, others	150,000
Los Pericos Municipal Park,	Municipality of San Salvador	500,000
Communities and biodiversity training	Citi Foundation, U.S. Fish & Wildlife Service, Critical Ecosystems Partnership Fund, Humane	150,000

<sup>24</sup> These amounts of financing are estimates per year. Some of them have not been confirmed.

Projects	Financing Source	Budget/Yr (US\$) <sup>24</sup>
program	Society International	
El Imposible Ecolodge	Johnson & Johnson, tourists	65,000
SalvaCERT Certification and Auditing	Diverse client base	250,000
SalvaASSIST	Rainforest Alliance/UNDP, and diverse client base	100,000
Editorial SalvaNATURA	US State Department, local businesses	80,000
Bird monitoring in protected areas	U.S. Fish & Wildlife Service, Institute for Bird Populations, Canadian Wildlife Service, private donors	75,000
Conservation of marine turtles	Private donors	12,000
<b>TOTAL</b>		<b>1,532,000</b>

Source: SalvaNATURA, 2010

**Table 22 Representative projects Salvadorian Zoological Foundation**

Project	Financing Source	Years
Sendero interpretativo para el Zoológico Nacional	Banco Nacional	6 meses, 1992
Centro de Interpretación para el Zoológico Nacional	SEMA	1 año, 1993-1994
Clínica para el Centro de Rescate de Fauna Silvestre	FIAES	1995-1996
Santuario Experimental de Fauna Silvestre	FIAES	1998-2001
Cuarentena para el Centro de Rescate de Fauna Silvestre	FONAES	1995-1996
Construcción de Recintos de rehabilitación para aves rapaces.	WSPA	1999
Construcción de Recintos para reptiles, aves y mamíferos.	FONAES	1999-2000
Registro de Tenencia de Fauna Silvestre de Especies Amenazadas y en Peligro de Extinción en el Área Metropolitana de San Salvador.	FIAES	2005-2006
Fortalecimiento de las operaciones del Centro de Rescate y Rehabilitación de fauna silvestre FUNZEL	HSI	2004
Fortalecimiento de las operaciones del Centro de Rescate y Rehabilitación	HSI	2005
Investigación sobre pesca incidental en la Bahía de Jiquilisco	NFWS	2010
Campaña para evitar el uso de la fauna silvestre como mascotas:	HSI	2010
Centro de Rescate de Fauna Silvestre en La Cañada, La Unión	HSI	2010
Programa Nacional de Protección y Conservación de Tortugas Marinas:	USAID	2010
Instalación de centro de investigación de recursos costero marino	WSFA	2010

Source: FUNZEL, per. com., 2010

## **Principal Issues and Priority Actions**

The economic benefits that flow from the conservation of biodiversity and forests are largely unquantifiable. After all, it is almost impossible to place an economic value on the preservation of a gene, species or ecosystem, especially when so little scientific information is available about them. Although conserving the eggs of marine turtles laid on its beaches, for example, may increase El Salvador's national pride and international prestige, the economic value of such intangible benefits, although almost certainly large, are impossible to measure quantitatively. The economic value of biodiversity and forests, however, has been reaffirmed in many international treaties and in Salvadorian policies, laws and regulations. Accurate calculations of the economic value of El Salvador's biodiversity and forests, even if they were possible, are therefore not required in order to justify adequate financing for their conservation.

Yet clearly El Salvador is not providing the funds required to finance the effective conservation of its biodiversity and forests. None of the ten categories of conservation actions in this report are receiving an adequate or reliable level of financing. The SANP receives a fraction of what it needs for its protected areas to be protected and managed in order to achieve their conservation objectives. Short-term, internationally funded projects finance almost all the conservation actions that are occurring in or outside of protected areas. Salvadorian national and local institutions, such as ministries and municipal environmental units, do not have the financial resources required to implement or to enforce the policies, laws and regulations for which they are legally responsible. The research on biodiversity and forests, which creates in itself so much economic value, and which provides the knowledge required for effective conservation actions, relies more on personal enthusiasm, dedication and funds or private individuals, than on systematic, sufficient financing from the government. El Salvador lacks educational programs in all the conservation fields. Conflict resolution processes are either not attempted or wither once started, largely for lack of financing. Until El Salvador establishes methods to finance consistently conservation actions in sufficient amounts it will not be able to implement the long-term, year-after-year conservation actions that the conservation of its biodiversity and forests requires.

There are many possibilities for actions to augment the funding for conservation in El Salvador but this report recommends that USAID/El Salvador follow-up on Barborak's recommendation for the establishment of a new fund, which he calls the National Fund for Protected Areas, within FIAES. He mentions that the possibility exists that the government of the United States could establish such a fund through another debt swap. The purpose of the fund would be to cover SANP's recurrent costs, particularly for its nuclear areas. He notes that FIAES should be interested in the establishment of such a fund since it would extend its existence, which now will end when the fund is used up (Barborak, 2003). To do the initial work of designing and obtaining financing for such a fund would require about US\$60,000.

### Box 3. Success Story: Conserving marine turtles in El Salvador

El Salvador's Pacific beaches are prime nesting sites for the threatened marine olive Ridley, green, hawksbill, and leatherback turtles. Year-around, but especially from June to September, mature females return to the same beach where they were born to lay their eggs. They drag themselves to the high tide line at night, scoop a nest with their back flippers, and lay from a few dozen to over a hundred eggs. Thirty-five to ninety days later, usually at night, the baby turtles hatch, push up through the sand and scramble towards the white line of breaking surf glistening against the night sky, trying to reach the ocean before a hungry predator snatches them. But each newborn does takes time to sniff the beach's sand, since years later its smell will guide them back to the same beach to mate. Then the females will make the same laborious trip to the high tide line as their mothers did before.

For decades, though, turtles were lucky even to hatch. Local "tortugeros" prowled the beaches with flashlights. When they spotted a nesting turtle they would scoop up the eggs and sell them to waiting "toponeros" who sold them on to men needing a macho boost. Hundreds of thousands of future turtles ended up accompanying beer and television in San Salvador's bars. Who knew better than the "tortugeros" themselves that turtle populations were being decimated? But at \$3.00 a dozen and with few steady jobs, they saw no reason to leave this easy income for others to collect.

As long ago as 1983, USAID/El Salvador was financing El Salvador's National Parks and Wildlife Service to buy and incubate turtle eggs. Since then El Salvador has accumulated experience and developed the procedures required for successful collection and incubation of turtle eggs and release of new-born turtles into the ocean. But small-scale projects faced legal and wealthy competition from San Salvador's bars for turtle eggs. The situation changed in 2009. The Government of El Salvador prohibited the collection or consumption of turtle eggs and USAID began to finance the Zoological Society of El Salvador to carry out a large-scale turtle egg collection and incubation program, combined with protection of beach habitat. During 2009, the consumption of eggs in San Salvador fell by 90 percent, 1,346,905 baby turtles lived to scramble to the ocean, and the "tortugeros" received an income of US\$377,500.

It is unclear, however, how the program will be finance after USAID financing ends in 2010. Perhaps part of the turtle eggs could be sold for consumption to raise funds for the collection and incubation of other turtle eggs and the restoration of beach habitat. Financing for the long-term operation of the turtle project remains to be determined. But now the "tortugeros" are on the side of conservation and are petitioning the government to continue the program in some form. .

## VI. CONCLUSIONS AND RECOMMENDATIONS

Although El Salvador is a small, densely populated country and humans have been affecting its forests and biodiversity for thousands of years, a large part of its original richness remains and makes an enormous contribution to the welfare of its citizens. Depending on its definition, some type of forest covers from a quarter to half of El Salvador and the forest area may be increasing. Although only a little over two million hectares in size, El Salvador has 11 vegetation types and numerous aquatic ecosystems. These ecosystems provide habitat to at least 56,000 species of living organisms, including 1,002 trees, 709 butterflies, 548 birds, 139 mammals and 127 reptiles and amphibians. It has tens of thousands more species of fungi, protista and echinoderms. El Salvador has only a few endemic plants and no endemic large animals, but its biodiversity does extend the range of many species that are endemic to northern Central America. As a small country, El Salvador's degree of genetic diversity within a species cannot be as high as in larger countries, but its genetic diversity remains almost unstudied and undervalued.

Most of El Salvador's terrestrial rare and threatened terrestrial species require primary forest habitat to survive as a species within the country and some of them also require large contiguous areas of primary forest habitat. The chances for conserving El Salvador's many rare and threatened terrestrial species thus depends largely on the future of its remaining 20,000 ha or so of primary forest habitat and the small area that remains in El Salvador of contiguous primary forest habitat currently is the greatest direct threat to its biodiversity. El Salvador's few relatively large blocks of primary forest occur within or adjacent to eight of its larger national protected natural areas. If this primary forest can be protected and expanded then El Salvador will have a chance to conserve its most threatened and endangered biodiversity.

The requirements for conserving El Salvador's aquatic biodiversity are not so clear, since less is known about the status of and threats to its aquatic biodiversity. Its numerous fresh water, estuarine and marine ecosystems and its 759 species of fish and 671 species of mollusks and crustaceans, however, indicate the diversity of aquatic species. That severe contamination affects all of El Salvador's fresh water bodies and that they have been invaded by many species of aggressive exotic animals and plants, suggests that some of El Salvador's rarer aquatic species are probably threatened, endangered or already extinct.

USAID/El Salvador's country strategy for 2010 to 2014 will assist El Salvador to achieve economic growth, improve the health and education of its citizens and establish a strong democratic system of governance. None of the actions USAID/El Salvador contemplates financing to assist El Salvador to achieve the objectives will adversely affect El Salvador's biodiversity and forests. They will not directly cause or indirectly induce changes or reductions in the habitat upon which El Salvador's rare or threatened species depend for their survival in El Salvador. Nor will they augment the direct threat to its biodiversity and forests from over-exploitation, contamination, aggressive introduced species or climate change. By adhering to the USAID Environmental Regulations, USAID/El Salvador, in any case, will systematically evaluate the potential adverse direct and indirect effects on El Salvador's biodiversity and forests of all specific actions it may finance. If any adverse impacts are identified, then USAID/El Salvador will take the actions required to avoid, mitigate or compensate for them, or will decide not to finance the proposed activity.

In fact, achieving the strategic objectives of economic growth, improved health and education, and democratic governance will also contribute to the conservation of El Salvador's biodiversity and forests. Economic growth will create a more prosperous El Salvador, and economic prosperity is the only long-term, reliable source of funds for adequately and reliably financing the actions that are required to conserve El Salvador's biodiversity and forests. Healthy and educated Salvadorians are not only a prerequisite for steady economic growth but they are more likely to understand and support the conservation of their country's biodiversity and forests. Effective democratic processes will make possible the orderly, peaceful reconciliation of different uses of land, thus permitting the conservation of the habitats that El Salvador's species require to survive. In sum, if Salvadorians are poor, unhealthy, uneducated, and ruled undemocratically, they are unlikely to conserve their heritage of biodiversity and forests. Thus the achievement of USAID/El Salvador's strategic objectives for the period 2010 to 2014 will also contribute to attaining some of the prerequisites in El Salvador for the long-term conservation of its biodiversity and forests.

Conservation actions, however, by no means should be postponed until El Salvador has achieved prosperity, health, education and democracy. El Salvador's biodiversity and forests already make an enormous, albeit often unquantifiable, contribution to the welfare of its people. Intact, functioning ecosystems, with their full complement of species and genes, underlie important sectors of El Salvador's economy, including tourism, fishing and aquaculture, hydroelectric power generation and agriculture. These economic activities create jobs for Salvadorians, and their spending multiplies through the economy creating yet more jobs and wealth. Conservation of forested watersheds reduces the risk from floods and landslides, catastrophes that in an instant can devastate the finances of individuals and the economy of the nation. Forests and trees provide the firewood upon which many Salvadorians still depend to cook their food, a basic element of both household economies and human health. Forested watersheds yield clean and abundant water, essential for human health and therefore for children's possibilities of becoming well-educated, a necessary condition for their financial stability and for El Salvador's steady economic growth. Economic prosperity and healthy, well-educated citizens, augment the possibilities for stable, democratic governance deepening its roots in El Salvador. In sum, conservation of El Salvador's biodiversity and forests are part and parcel of El Salvador's development into a prosperous, healthy, educated and democratic nation.

USAID/El Salvador, therefore, during the period 2010 to 2014, should not just avoid actions that would cause adverse effects on El Salvador's biodiversity and forests. Rather, during this period it should plan, design and finance four broad types of actions to assist El Salvador to conserve its biodiversity and forests.

First, USAID/El Salvador should coordinate systematically and intensely with other institutions when it conceives, designs, finances, implements and evaluates conservation actions. Such coordination will enable it to assist El Salvador to avoid duplication of conservation actions, reinforce conservation initiatives, stimulate the sharing of successful conservation experiences and create institutional momentum for achieving a common set of conservation objectives, as defined by the Government of El Salvador. In particular, USAID/El Salvador should coordinate with the General Direction for Natural Patrimony (DGPN) in the Ministry of Environment and Natural Resources, El Salvador's permanent institution with legal responsibility for conserving its biodiversity and forests. Every action USAID/El Salvador finances to support conservation should also serve to strengthen DGPN's capabilities. While USAID/El Salvador will leave, DGPN, or a similar government unit, will remain permanently, and conservation of biodiversity and forests is a permanent, not a temporary, enterprise.

The multiple, reinforcing links between conservation, economic growth, health, education and democratic governance demand that USAID/EI Salvador coordinate between its strategic objectives, ensuring it exploits fully every possibility for mutually reinforcing actions. Likewise, USAID/EI Salvador, through the DGPN, should coordinate the conservation actions it finances with other EI Salvadorian public and private institutions that play a role in conservation of its biodiversity and forests, including the Ministries of Agriculture and Livestock and of Tourism, municipal governments, the Central University of San Salvador, the Museum of Natural History and the National Botanical Garden, and conservation NGOs, such as SalvaNATURA and FUNZEL. In every case, USAID/EI Salvador should seek through coordination to strengthen these institutions, avoiding any possibility of supplanting them in their functions. Effective coordination will not require USAID/EI Salvador to expend funds, but it will require that USAID/EI Salvador adopt an approach to conservation derived from an attitude of achieving conservation objectives through support for Salvadorian institutions.

Second, USAID/EI Salvador should strengthen EI Salvador's institutional capacity to identify, evaluate, and avoid, mitigate or compensate when necessary potential negative effects of development activities on its biodiversity and forests. If development activities in EI Salvador pull one way and conservation activities pull another, conservation is sure to lose out, usually causing irreparable harm to EI Salvador's prospects for economic growth and prosperity. The environmental assessment process provides a systematic, legal methodology to ensure that development and conservation do not contradict each other. Within the Ministry of Environment and Natural Resources, the General Directorate of Environmental Management (DGMA) is legally responsible for designing, operating, evaluating and adapting EI Salvador's system of environmental assessment. The Minister of MARN has identified two core weaknesses in EI Salvador's environmental evaluation process. One weakness is that the DGMA lacks sufficient technical expertise, especially regarding water contamination. Consequently, the environmental assessment process stifles and discourages investments rather than contributing to their financial success. The second weakness is that the environmental assessment process often stimulates conflict over access to land and natural resources rather than contributing to the resolution of conflicts and to good choices about how to use land and natural resources. Even without a large expenditure of funds, USAID/EI Salvador could help the DGMA to correct these weaknesses in EI Salvador's environmental review process. In particular it could follow up on the Minister's suggestion that USAID/EI Salvador could coordinate technical cooperation and training from the U.S. Environmental Protection Agency and provide assistance in conflict resolution processes as applied to conflicts over the use of land and natural resources. Through such support, USAID/EI Salvador would be helping EI Salvador to align its economic development with conservation of its biodiversity and natural resources.

Third, USAID/EI Salvador should assist EI Salvador to conserve its biodiversity and forests by ensuring that the activities it finances are well-designed and effectively implemented. Excellent design and effective implementation will result if five prerequisites are met. (a) Well-designed projects must build on the lessons of prior conservation experiences in EI Salvador. To distill such lessons requires objective evaluations of prior conservation projects. (b) To ensure high technical quality in the design and implementation of the conservation measures it finances, USAID/EI Salvador must contract with the most qualified and experienced specialists it can find in different conservation fields. (c) The conservation actions USAID/EI Salvador finances must reflect EI Salvador's conservation priorities. If they do not, even impressive short-term outputs or outcomes will be unlikely to lead to permanent conservation implemented by Salvadorians working within and through Salvadorian institutions. (d) The conservation actions USAID/EI Salvador finances should identify specific conservation objectives and their progress towards

those objectives should be constantly and objectively monitored, evaluated and adapted. There is much to learn about how to carry out effective conservation in El Salvador. Continuous learning while carrying out conservation projects will develop Salvadorian institutional capacity, while also improving project implementation. (5) Finally, no matter how much they may achieve, if the conservation activities USAID/El Salvador finances do not at the same time strengthen El Salvador's permanent conservation institutions, then they will not produce long-term conservation results. All the conservation actions that USAID/El Salvador finances should aim to increase the permanent institutional capacity in El Salvador for conserving its biodiversity and forests.

Fourth, USAID/El Salvador should assist El Salvador to conserve its biodiversity and forests by financing priority conservation actions. This report defines ten categories of inter-related conservation actions that are required for El Salvador to conserve its biodiversity and forests. For each of these categories, the report recommends priority actions for USAID/El Salvador to finance. The following paragraphs briefly summarize these priority actions and provide an estimate of the cost of implementing them.

- 1) Conservation within Protected Areas: Protected areas conserve the natural habitat which a country's threatened and endangered species require in order to survive as a species within the country. The data on the area and number of El Salvador's protected area included in the System of Natural Protected Areas (SANP) are unclear, but it may have as many as 165 existing or potential protected areas, and they may include as many as 70,583 ha. El Salvador's rarest and most threatened terrestrial species are found in the eight largest of these areas, whose total area is 14,133 ha. The chaparral community and the pine-oak vegetative community of northeast El Salvador, however, are not represented at all in the SANP. This report recommends that USAID/El Salvador concentrate its financing under this category of conservation action on (a) providing the resources to ISTA and MARN to finalize the legal status of the 89 pending areas that should be transferred to MARN under the terms of the 1980 land reform and further transferring to the municipal governments those areas that are too small to remain under the administrative control of MARN; (b) assisting the General Direction for Natural Patrimony to establish the eight protected areas on a firm legal, technical, administrative and financial basis; (c) studying the possibilities for adding a large protected area in northeast El Salvador; (d) preparing technically sound management plans for the eight priority areas and (e) assisting ISTA to quickly and effectively transfer the remaining natural areas under its jurisdiction to the State. The total cost for these three priority actions is estimated to be US\$1,665,000.
- 2) Conservation outside of Protected Areas: El Salvador's protected areas cover less than 3 percent of the country and are generally not linked to each other by the corridors of habitat that would allow the movement of animals from one to the other and thus the interchange of genes. The available data are contradictory, but secondary forest may cover as much as half of the country and has expanded in area during the last two decades. Six types of areas outside of protected areas have been delimited in El Salvador, while another type, buffer zones, needs also to be delimited. These delimitations serve to guide the selection of where to implement conservation actions outside of the protected areas themselves. The report recommends that USAID/El Salvador finance (a) an evaluation of the usefulness of these conservation designations; and (b) an evaluation of the El Salvador's secondary forest and (c) an evaluation of prior conservation actions that have been carried out outside of protected areas in El Salvador. The estimated cost of these priority conservation actions is US\$195,000.

- 3) Policies, Strategies, Laws and Regulations: The conservation of El Salvador's biodiversity and forests requires coherent, effective conservation policies, strategies, laws and regulations. El Salvador is signatory to the principal international conservation treaties and regional conservation agreements, and it has formulated large bodies of policies, strategies, laws and regulations related to the conservation of its biodiversity and forests. The report recommends that USAID/El Salvador (a) support MARN in the preparation of President Funes' report to Salvadorians on the state of El Salvador's environment that is scheduled for mid-2010; and (b) support MAG to formulate a policy for the management of El Salvador's secondary forest. The estimated cost of these actions is US\$135,000.
- 4) Conservation Research: El Salvador is doing much less research than it needs to in order to accumulate the scientific knowledge upon which its conservation actions should be designed, implemented and evaluated. This report recommends that USAID/El Salvador (a) finance the design of a fund for research on biodiversity and forests and then provide seed money for the fund at a total cost of US\$785,000; and (b) finance the collection of baseline data for monitoring the effects of climate change in El Salvador at a cost of US\$240,000.
- 5) Conservation Education: To conserve its forests and biodiversity, El Salvador requires adequate numbers of well-educated conservation scientists, professionals, technicians and workers, in a variety of professional fields. Salvadorian educational institutions are not providing any conservation education and few Salvadorians are studying conservation professions outside of El Salvador. This report recommends that USAID/El Salvador finance (a) a study of El Salvador's educational needs for conservation; and (b) educational scholarships for study outside of El Salvador in conservation fields. The estimated cost of the actions is US\$1,295,000.
- 6) Institutional Capacity: El Salvador's ability to conserve its biodiversity and forests will largely depend on the capacity of its public and private conservation institutions. There are many possibilities for strengthening El Salvador's conservation institutions but this report recommends that USAID/El Salvador finance (a) the participation of municipal governments in the process of transferring the responsibility for El Salvador's many small public protected areas to municipal governments; (b) a study that clarifies the roles of the different Salvadorian conservation institutions; and (c) activities to expand and strengthen the role of privately owned protected areas in the conservation of El Salvador's biodiversity and forests. The estimated budget for these actions is US\$765,000
- 7) Conflict Resolution and Land Use Planning: Conservation of El Salvador's biodiversity and tropical forests requires effective planning and regulation of the uses of the country's terrestrial and marine territory. A systematic, legal conflict resolution process should be incorporated into the land use planning and regulation process. This report recommends that USAID/El Salvador finance (a) training in conflict resolution processes and (b) a fund for the MARN to design and implement conflict resolution processes. The estimated cost of US\$140,000.
- 8) Public Support for Conservation: Programs that effectively communicate conservation problems, issues and solutions to different segments of Salvadorian society, will increase public understanding and support for and reduce opposition to conservation

measures. Therefore, a public education program, carried out by a Salvadorian institution, is urgently needed in order to achieve the conservation of El Salvador's biodiversity and forests. This report recommends that USAID/El Salvador finance such a program at a cost of about US\$375,000.

- 9) Financial Incentives for Conservation: Financial gain is a powerful influence on people's decisions that affect the conservation of biodiversity and a forest. Aligning positive financial incentives with required conservation actions and objectives will therefore stimulate the conservation of El Salvador's biodiversity and forests. There are many potential ways in which financial incentives could be increased for conservation. This report recommends, however, that USAID/El Salvador finance an evaluation of how assigning exclusive rights to natural resources could increase the conservation of threatened or endangered species in El Salvador. Such an evaluation would require about US\$45,000.
  
- 10) Financing for Conservation: Conservation in El Salvador is severely underfinanced, especially relative to the enormous economic importance of its biodiversity and forests. This report recommends that USAID/El finance the studies and actions required to establish a new fund within FIAES whose income would be dedicated to the management of the eight priority national protected areas identified in this report. Designing and obtaining financing for such a fund and providing initial seed funding would require about US\$560,000.

Table 23 summarizes the priority actions recommended in this report by category of conservation action.

**Table 23 Priority conservation actions by category with estimated required budget**

<b>Priority Conservation Action by Category</b>	<b>Estimated Budget</b>	<b>Type of Activity</b>
<b>Conservation within Protected Areas</b>	<b>1,665,000</b>	
Support ISTA & MARN to complete legalization of 89 areas	500,000	Program
Analyze enlargement of eight priority areas	480,000	Study
Study protected area for northeast	45,000	Study
Prepare management plans for 8 priority protected areas	640,000	Study
<b>Conservation outside of Protected Areas</b>	<b>195,000</b>	
Evaluate prior conservation projects	60	Study
Evaluate conservation designations	45,000	Study
Evaluate secondary forest	90,000	Study
<b>Policies, laws &amp; regulations</b>	<b>135,000</b>	
Support report on the State of El Salvador's Environment	45,000	Program
Formulate policies for secondary forest	90,000	Study
<b>Conservation Research</b>	<b>785,000</b>	
Design fund for field conservation research	45,000	Study
Provide financing for research fund	500,000	Fund
Collect baseline data for climate change	240,000	Study
<b>Conservation Education</b>	<b>1,295,000</b>	
Finance advanced conservation education in other countries	800,000	Training
Design curriculums for Salvadorian conservation education	45,000	Training
Train municipal and community leaders	450,000	Training
<b>Institutional capacity</b>	<b>765,000</b>	
Transfer small protected areas to municipalities	500,000	Program

Analyze institutional roles and responsibilities	45,000	Study
Support privately owned protected areas	220,000	Program
<b>Conflict resolution and land use planning</b>	<b>140,000</b>	
Train in conflict resolution techniques	40,000	Training
Fund for MARN conflict resolution & land use planning	100,000	Study
<b>Public support for conservation</b>	<b>375,000</b>	
Design communication program	15,000	Study
Implement communication program	360,000	Program
<b>Financial incentives</b>	<b>45,000</b>	
Evaluate exclusive rights	45,000	Study
<b>Financing for Conservation</b>	<b>560,000</b>	
Design a conservation fund	60,000	Study
Finance conservation fund	500,000	Fund
<b>TOTAL</b>	<b>5,960,000</b>	

As indicated in Table 23, this report recommends that USAID/EI Salvador finance 22 actions that are a priority for the conservation of El Salvador's biodiversity and forests. Of these actions, 14 involve studies, 2 involve financing for funds, 4 involve training, and 5 involve implementing programs.

The recommended funding has been divided between all ten of the conservation actions. The largest amount (US\$1,665,000) would be for conservation within protected areas. The second largest amount (US\$1,295,000) would go to conservation education, especially to finance advanced degrees in conservation fields. The third largest amount of funding (US\$765,000) would go for increasing the institutional capacity of Salvadorian conservation institutions. US\$560,000 would be used to start a conservation fund to finance the management of El Salvador's eight priority protected areas. Smaller amounts would be used to support the other categories of conservation actions,

The report recommends a budget for financing the priority conservation actions recommended in this report over the period from 2010 to 2014 of US\$5,960,000. This is a relatively small investment in the conservation of El Salvador's biodiversity and forests relative to the enormous economic value of El Salvador's biodiversity and forests. The investment of these funds would assist El Salvador to resolve many of its priority conservation issues and at a critical point in the history of its conservation efforts help it to establish the conditions for achieving the long-term conservation of its biodiversity and forests.

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## **APPENDIX B. Scope of Work**

The El Salvador Country Analysis on Tropical Forest and Biological Diversity – Sections 118 / 119 of the Foreign Assistance Act, will include an overall review of the current status of tropical forests and biological diversity in El Salvador.

1. Compile information related to, and describe the tropical forests and biological diversity of El Salvador including their current status and trends;
2. Describe the factors affecting the management of these natural resources, including the principal threats and impediments to conservation and sustainable management of tropical forests and biodiversity in El Salvador.
3. Review the current institutional infrastructure for the management of tropical forests and biodiversity, including a description of major organizations, both public and private, which have a role in this process. Interview key personnel of key institutions.
4. Review the legislative basis, both national and local, for the protection of biological resources, including tropical forests, in El Salvador (including the ratification of and compliance to international treaties and agreements such as CITES, Convention on Biological Diversity, Inter American Convention for the Protection and Conservation of Sea Turtles, RAMSAR, and the effectiveness of national implementation),
5. Identify the full range of cost effective and implementable actions (including priorities) necessary to achieve sustainable management of tropical forests and biological diversity in El Salvador, and;
6. Identify the extent to which the actions proposed for support by USAID/El Salvador meet the needs thus identified, and recommend any further actions not described or outlined in the concept papers. Analyze the effects of USAID/El Salvador's entire proposed strategy (FY 2010 – FY 2014) on El Salvador's tropical forests and biodiversity. In particular, the proposed strategic objectives of Democracy and Governance, Economic Growth and Environment, and Human Investment should be carefully reviewed.

## **APPENDIX C. Persons Interviewed**

Ing. Ricardo Aguilar, Coordinador regional para la implementación de medidas ambientales, CCAD

Lic. Karla Albanez, Presidenta, Instituto Salvadoreño de Transformación Agraria (ISTA)

Dra. Rosa María Araujo, Enlace con Usuarios, SNET/MARN

Dr. Enrique Barraza, Especialista en recursos marinos, DGPN, MARN

Lic. Juan Pablo Domínguez, Sección de Áreas Protegidas, DAI

Lic. Maritza Erazo, Gerente Ordenamiento Territorial, DGPN/MARN

Lic. Carlos Figueroa, Enlace MARN/ISTA para la Transferencia de Tierras, DGPN, MARN

Ing. Alejandro Flores Bonilla, Director General de Ordenamiento Forestal, Cuencas y Riego, Ministerio de Agricultura (MAG)

Ing. Luis García, Director del Servicio Meteorológico, SNET/MARN

Dr. Alex Hasbún, Presidente, Fundación Zoológica del El Salvador (FUNZEL)

Lic. Néstor Herrera, Gerente de Vida Silvestre, DGPN, MARN

Dr. Oliver Komar, Scientific Advisor and leading authority on Salvadorian Birds, SalvaNATURA.

Ing. Medardo Lizano, Director General (y Autoridad Administrativa de CITES), Dirección General de Sanidad Vegetal y Animal (DGSVA/MAG)

Ing. Daisy López, Hidrología, SNET/MARN

Lic. Zulma de Mendoza, former head, Áreas Protegidas y Corredor Biológico Mesoamericano, MARN

Mr. Kenneth Miller, Deputy Director, Millenium Challenge Corporation

Arq. Álvaro Moisés, Directo Ejecutivo, SALVANATURA

Lic. Jorge Monterrosa, Jefe Técnico, Jardín Botánico La Laguna

Lic. Salvador Nieto, Director Ejecutivo, MARN

Sr. Juan José Orellana, leading authority on fishes and crustaceans of El Salvador

Ing. Jorge Oviedo, Director Ejecutivo, Fondo de la Iniciativa de las Américas para El Salvador (FIAES)

Lic. Raúl Miranda, Director del Parque Zoológico Nacional, CONCULTURA

Ing. René Núñez-Suárez, Inventor, turbo-combustión y turbo cocina

Dr. James Owen, mastozoologist, leading authority on Salvadorian mammals

Lic. Lina Pohl, Vice-Ministra de Medio Ambiente y Recursos Naturales (MARN)

Dr. Jorge Quezada, General Director, Patrimonio Natural, MARN

Lic. Marta Lilian Quezada, Educación Ambiental, DAI / SalvaNATURA

Lic. María Luisa Reina. Botanist, former director Jardín Botánico La Laguna and leading authority on Salvadorian trees and their uses.

Ing. Herman Rosa, Ministro, Ministerio de Medio Ambiente y Recursos Naturales (MARN)

Lic. Mateo Salomón, Cambio Climático, PNUD

Lic. Diego Salcedo, Economista ambiental

Lic. Sonia Salaverría, Directora General, CENDEPESCA, MAG

Lic. Alfonso Sermeño, Técnico en Áreas Naturales, DGPN, MARN

Lic. Roberto Soler, owner of a coffee plantation on the slopes of the San Salvador volcano

Ing. Alejandro Valiente, Sector forestal privado

Lic. Noemi Ventura, Head of Biology Department, National University of El Salvador

Lic. Jeremías E. Yanes, Especialista en Bioseguridad y Punto Focal, DGPN, MARN

Ing. Hugo Zambrana, Especialista Forestal, DGPN, MARN

## **APPENDIX D. Itinerary and Field Trips**

### **WEEK 1: PLANNING**

Tuesday, 6	Preparation of Work Plan
Wednesday, 7	Preparation & presentation of Work Plan
Thursday, 8	Review of Documentation
Friday, 9	Presentation of Work Plan to USAID
Saturday, 10	Field Trip, 7:00 A.M. to 6 P.M. Bahia Jiquilisco, turtle project
Sunday, 11	Review documentation

### **WEEK 2: INTERVIEWS, FIELD TRIP & REVIEW OF DOCUMENTATION**

Monday, 12	Interviews	
	10:00 – 12:00	Oliver Komar, Alvaro Moises, SalvaNATURA
	2:00 – 3:00	Hugo Zambrana, MARN Forestry
Tuesday, 13	Interviews	
	7:00 AM.	Zulma de Mendoza, MARN, EIA Process
	9:00 AM	Juan Jose Orellana, Independent Fish
	4:00 – 6:00	Oliver Komar & Alvaro Moises, SalvaNATURA
Wed., 14	Interviews	
		Marta Lilian Quezada, DAI
		Jose Edgardo, DAI
Thursday, 15	FT Montecriste	
Friday, 16	Interviews	
	Marta	
	12:30 – 1:45 PM	Rene Unas, San José Villa Nueva, efficient stove
	2:30 – 3:30 PM	Enrique Baraza, MARN
Saturday, 17	Los Volcanoes NP	
Sunday, 18	Draft report	

### **WEEK 3: FIELD OBSERVATIONS & INTERVIEWS, DRAFT REPORT PREPARATION**

Monday 19	Interviews	Carla Handel, Vice Minister of Education
	1:30 – 2:30	Nestor Herrera, Wildlife Dept. MARN
	2:45_3:45	Carlos Figueroa, Natural Patrimonio, Transfer of Lands from Agrarian Reform
Tuesday 20	Field Trip, Los Cobanas	
Wednesday, 21	Field Trip, El Imposible	
Thursday, 22	Interviews, USAID Staff	
Friday, 23	Report Preparation	
Saturday, 24	Draft report preparation	
Sunday, 25	Draft report preparation	

### **WEEK 4: PREPARATION OF DRAFT REPORT**

Monday, 26	Draft report preparation
Tuesday, 27	Draft report preparation
Wednesday, 28	Draft report preparation
Thursday, 29	Draft report preparation
Friday, 30	Draft report preparation
Saturday, 31	Draft report preparation
Sunday, 1	Draft report preparation

**WEEK 5: PRESENTATION & DISCUSSION OF DRAFT REPORT**

Monday, 2	Draft report preparation
Tuesday, 3	Presentation to USAID
Wednesday, 4	Kernan leaves El Salvador

**PERIOD OF REVIEW**

Nov 5 to 15	USID review & comments by SO
Nov 16 to January 31	Preparation of Final Report

## **APPENDIX E. Biographical Sketch of Team Members**

Bruce Kernan has a strong applied professional background in forestry and environment and 30 years of experience working on USAID programs related to the conservation of biological diversity, forest management and protected area management in Latin America predominantly in Ecuador, where he has lived since 1983. He has previously prepared Tropical Forest and Biodiversity Country Analyses (FAA 118 & 119) for USAID programs in Peru, Bolivia, and Ecuador as well as numerous environmental assessments, programmatic environmental assessments, and strategic planning documents. He has in-depth knowledge of USAID environmental programs and procedures in Latin America as a result of being the USAID/Ecuador Mission Environmental Officer from 1984 to 1988, USAID Regional Environmental Advisor for South America from 1994 to 1998, and an independent environmental consultant, mostly to USAID from 1999 to the present. He is fluent in written and spoken Spanish. As a frequent Team Leader he has developed excellent interpersonal skills that have enabled him to effectively relate to a wide variety of stakeholders in all the countries in which he has worked. His education includes a Master of Professional Studies degree in agriculture and environment from Cornell University, a Master of Forest Science degree in silviculture and forestry economics from Yale University, a Bachelor of Arts degree in geology and anthropology from Hamilton College and a certificate in forestry technology from the New York State College of Forestry.

Francisco Serrano is a Salvadorian biologist trained in terrestrial ecology, with emphasis on the management of natural protected areas and wildlife. Born in San Francisco, California, He studied Biology at the University of Santa Clara, California, and Gonzaga University in the state of Washington. He then went on to study Vertebrate Ecology at the University of Georgia (Athens), agricultural economics at Oxford University, England, and finally, as a Fullbright Fellow, Agricultural Ecology at Cornell University, Ithaca, N.Y.

Francisco started as curator of insects at the National Museum David J. Guzmán, then became professor of general, invertebrate but above all vertebrate zoology at the Biology Department of the University of El Salvador. After this he became the founder and organizer of Salvadorian National Parks and Wildlife Service. This experience led to his holding the position of Executive Director of the Salvadorian Institute of Natural Resources.

Though he has also been advisor to the Minister of the Environment and Natural Resources of El Salvador, Francisco's main activities after leaving the Government has been as consultant in such activities as coordinating the elaboration of a two volume publication on the Natural History and Ecology of El Salvador, the National Strategy on Biodiversity, environmental and institutional evaluations, and several other major projects with the public, private and international organization sectors. He has also been active in the organization and launching of several environmental NGOs. His main interests center on Butterflies and Birds, Management of wildlife and Protected Areas in El Salvador, Natural Park design (for both urban and rural areas) and mangroves. His role as ecologist/project coordinator has led to his having to work with many of El Salvador's leading professionals in soils, hydrology, climatology, geology, botany and other related disciplines. Currently, Francisco is General Manager and co-owner of Bioproductores de El Salvador, a butterfly farm enclosed in a likewise private nature reserve.