Haiti Biodiversity and Tropical Forest Assessment

(Sections 118 and 119 of the Foreign Assistance Act)

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ABBREVIATIONS AND ACRONYMS

AECID	Agencia Española de Cooperación Internacional para el Desarrollo
ANAP	Agence National des Aires Protégées
BME	Bureau des Mines et de l'Energie
CAMEP	Centrale Autonome Métropolitaine d'Eau Potable
CBD	Convention on Biological Diversity
CCD	Convention to Combat Desertification
CEPF	Critical Ecosystem Partnership Fund
CIDA	Canadian International Development Agency
CMO	Comission de la Mise en Œuvre de l'ANAP
DEED	Développement Economique pour un Environnement Durable
ESMAP	Energy Sector Management Assistance Program
FAES	Fonds d'Assistance Économique et Sociale
FAO	Food and Agriculture Organization (United Nations)
FREH	Fonds pour la Réhabilitation de l'Environnement Haïtien
GEF	Global Environment Facility
IDB	Inter-American Development Bank
IHSI	Institut Haïtien de Statistique et d'Informatique
MARNDR	Ministère de l'Agriculture, des Ressources Naturelles, et du Développement Rural
MARPOL	UN convention on marine pollution
MDE	Ministère de l'Environnement
MENFP	Ministère de l'Education Nationale et de la Formation Professionnelle
MPCE	Ministère de la Planification et de la Coopération Externe
MSPP	Ministère de la Santé Publique et de la Population
MTPTC	Ministère des Travaux Publics, Transports et Communications
NBSAP	National Biodiversity Strategy and Action Plan
NEMS	National Environmental Management System
PAGE	Projet d'Appui à la Gestion de l'Environnement
POP'S	Cartagena Protocol on Biosafety, Pollutants Organic Persistent Convention
SNEP	Service National d'Eau Potable
TNC	The Nature Conservancy
UMO	Unité de Mise en Œuvre de l'ANAP
UNFCCC	Conventions such as United Nations Framework Convention for Climate Change
UNDP	United Nations Development Program
USAID	United States Agency for International Development
WINNER	Watershed Initiative for National Natural Environmental Resources

EXECUTIVE SUMMARY

This Biodiversity and Tropical Forest Assessment report has been prepared to provide information and analysis as requested by USAID/Haiti, required by the U.S. Congress, and stipulated in the U.S. Foreign Assistance Act (FAA) of 1961. This report updates the 2006 Biodiversity and Tropical Forest Assessment report and seeks to provide a concise and targeted assessment to inform the USAID/Haiti Mission's strategic planning, program development, and implementation. This assessment includes:

- An overview of the status of biodiversity and tropical forests in Haiti;
- An analysis of threats to biodiversity and tropical forests;
- The institutional, policy and legislative framework for environmental management in Haiti;
- Current interventions in the environmental sector, bi- and multilateral donors, non -governmental organizations (NGOs), the private sector and other institutions; and
- An examination of how the proposed activities in USAID/Haiti Five Year Strategic Plan could contribute to conservation needs and includes recommendations for actions related to the US Government's goals.

The Caribbean is an internationally recognized biodiversity hotspot, and is one of the world's greatest centers of endemic biodiversity as a result of the region's geography and climate: an archipelago of habitat-rich tropical and semi-tropical islands tenuously connected to surrounding continents. Haiti is one of the richest countries in the Caribbean in terms of botanical diversity. Haiti boasts a rich fauna as well, of which 75% are considered endemic.

Less than two percent of Haiti remains forested. Those forested areas are globally important because they harbor endemic species on the brink of extinction. With a Coastline of 1775 km and a coastal shelf of 5000 km^2 and five main offshore islands, Haiti's coastal and marine resources include examples of a remarkably varied ecology rich in biodiversity

Officially, the Haitian Government has identified a total of 35 protected areas covering about 6% of the nation. However, the percentage of effective protected areas is evaluated at no more than 0.5% of the surface of the country.

The deforestation of Haiti and subsequent land uses, resulting in erosion, altered water flows, flooding, sedimentation, and destruction of aquatic ecosystems have been and continue to be the greatest threats to biodiversity in the country. Unsustainable and destructive exploitation of fisheries, exotic species, and development are also threats to biodiversity and tropical forests in Haiti.

The earthquake of January 2010 had direct and is having continuing indirect effects on the biodiversity of Haiti, such as blocking river flows, and displacing people from Port-au-Prince, increasing pressure on ecosystems outside the city. Effects of natural disasters will be exacerbated as climate change results in increased frequency and severity of weather events, such as hurricanes. Properly functioning ecosystems, rich in biodiversity and healthy tropical forests would be more resilient to extreme weather events occurring in the future.

The 5 Principles, 4 Pillars, 3 Development Corridors, 2 Objectives and 1 Goal of the US Government Strategic Framework that will be implemented by USAID Haiti are compatible with biodiversity and tropical forests, as long as implementation of projects continues to include project level assessments. Much more can be done for biodiversity and tropical forests and the need is great. Recommendations and proposed actions related to the strategic framework are offered.

1. INTRODUCTION

As part of the documentation for the new five-year Strategic Plan, USAID/Haiti is required by Sections 118 and 119 of the Foreign Assistance Act to complete an analysis of tropical forests and biological diversity in Haiti. Summary of relevant parts of FAA Sec 118 and 119:"FAA Sec 118 (e) Country Analysis Requirements. Each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of

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

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

"FAA Sec 119 (d) Country Analysis Requirements. Each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of

(1) the actions necessary in that country to conserve biological diversity, and

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

A draft concept paper for the new five-year strategic plan has been completed. In order to integrate environment issues into Haiti's new strategy, it is necessary to conduct an analysis of the current status of tropical forests and biodiversity in Haiti, identify actions needed to conserve biodiversity and tropical forests, assess the current and planned activities of other donor programs and stakeholders in meeting these needs, and analyze the planned activities of USAID/Haiti in reference to the actions needed. This country analysis has mainly been a compilation and review of existing information, coupled with analysis, synthesis, and corroboration and feedback from major players. A primary resource report is the May 2006 "Haiti Country Analysis of Tropical Forestry and Biodiversity" by D.B. Swartley and J.R. Toussaint. Since the 2006 analysis the environment of Haiti has been affected by four hurricanes and tropical storms in 2008 and an earthquake that devastated Port-au-Prince and surrounding portions of Haiti on January 12, 2010. This 2010 analysis provides updated information reflecting the changed environmental conditions as well as changes in the socio-political circumstances.The focus of this analysis is threefold:

1. Assess the conservation status of biodiversity and forests in Haiti;
2. identify actions necessary to better conserve biodiversity and tropical forests; and
3. describe how and to what extent actions proposed in USAID/Haiti's new upcoming Strategy and/or operational plans meet, or could meet, the biodiversity and tropical forest needs thus identified.

This assessment also examines the following

- That the planned activities and investments are not likely to adversely affect tropical forestry and biodiversity.

- The opportunities for program synergy among the strategic objectives that could contribute to the conservation of tropical forests and biodiversity.
- Other issues and opportunities related to forestry and biodiversity conservation for USAID assistance that may match the Mission's overall strategy thrust.

This assessment also serves as a planning tool to assist the Mission in better integrating environment issues into their overall program. Rebuilding after the earthquake of January 12, 2010 is a high priority for the USAID mission and the Government of Haiti. According to the Post-Disaster Needs Assessment following the earthquake (GOH 2010), environmental indicators were already at danger levels prior to the earthquake. The latter severely damaged the Haitian apparatus of state, exacerbated the pressure on the environment and natural resources and laid bare the extreme vulnerability of the country to unforeseen events.

The US Government goal of a stable and economically viable Haiti is directly related to environmental vulnerability and therefore has direct impacts on biodiversity. In an assessment of environmental vulnerability in Haiti, Smucker et al. (2007) concluded that the root causes of environmental disaster in Haiti are acute poverty, rapid population growth and unplanned urbanization. Prospects for reduced vulnerability to natural disaster in Haiti are very limited in the absence of broad based economic development.

Unfortunately, because of the decades of environmental degradation, and existing threats, if immediate efforts are not simultaneously made to protect the existing biodiversity of Haiti, globally important species, communities and sites may be lost forever.

2. STATUS OF BIODIVERSITY AND TROPICAL FORESTS IN HAITI

Haiti is situated on the western third of the island of Hispaniola, located between 18˚ and 20º north of latitude and between 71˚30 and 74˚ 30 west of longitude (Figure 1). Haiti's landscape (27,750 km^2), consists of rugged mountains interspersed with coastal plains and rivers valleys. The country has been divided politically into 10 *Departments* (Provinces): Artibonite, Centre, Grande-Anse, Nippes, Nord, Nord-Est, Nord-Ouest, Ouest, Sud, Sud-Est. Haiti also has six satellites islands (totaling 954 km^2), namely Ile de la Tortue (off the north coast), Ile de la Gonave (northwest of Port-au-Prince), Ile à Vache (off the southern tip of southwestern Haiti), Les Cayemites (off the north coast of the Southern Peninsula) and the disputed island of Navassa.

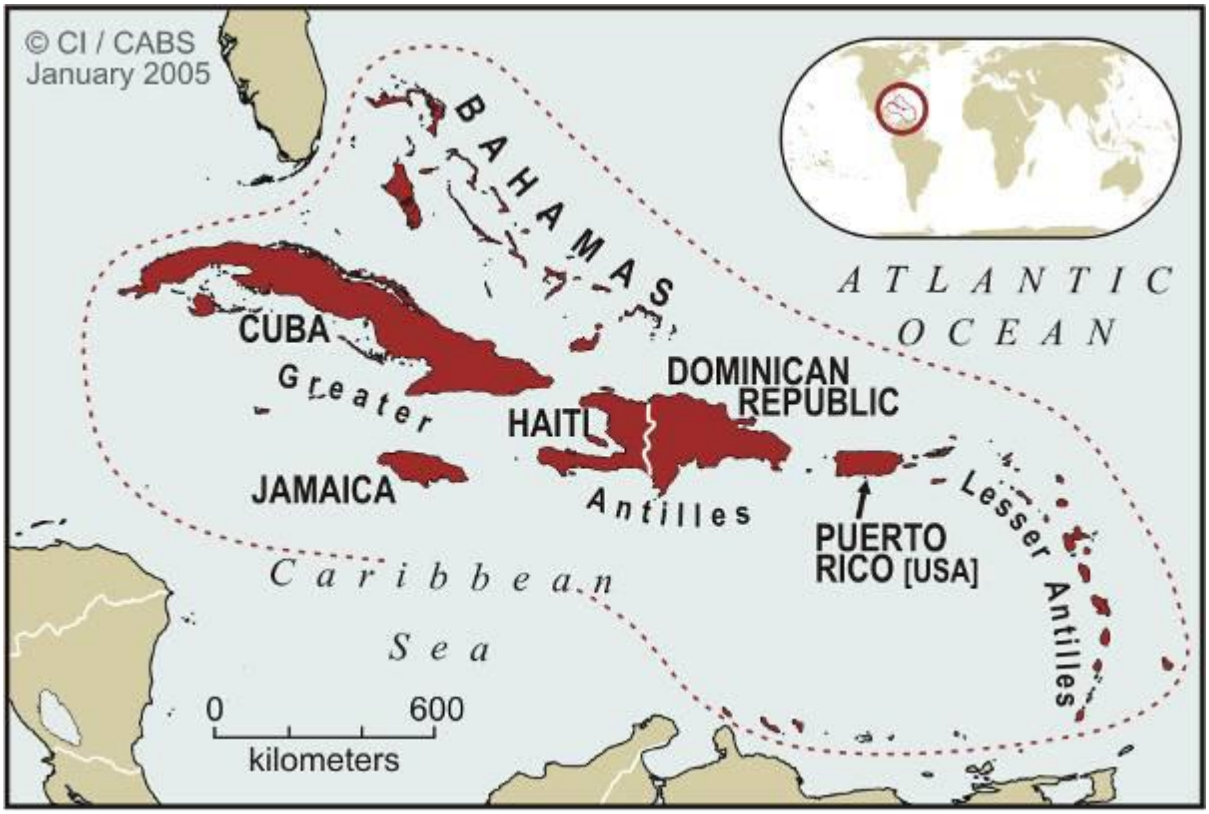

Figure 1. Haiti in the Caribbean Islands. Source CEPF 2010

Although affected by severe environmental degradation problems, the country is endowed with an enviable biodiversity which is an undeniable asset. (Erlich et al. 1987). In fact, its insularity and mountainous terrain give rise to a multiplicity of microclimates that some might call "biological or living jewels". The CEPF in its 2010 Ecosystem Profile: *The Caribbean Islands Biodiversity Hotspot* has identified a total of 17 Key Biodiversity Areas for Haiti (Figure 2) with five (5) Wholly Irreplaceable Sites (so named because they contain the only known populations

of at least one globally threatened species), namely Massif de la Hotte, Massif de la Selle (which includes Pic la Selle, Haiti's highest point), Dame-Marie (Grande-Anse Department), Plaisance (Northern region), Presqu'île du Nord-Ouest I and II.

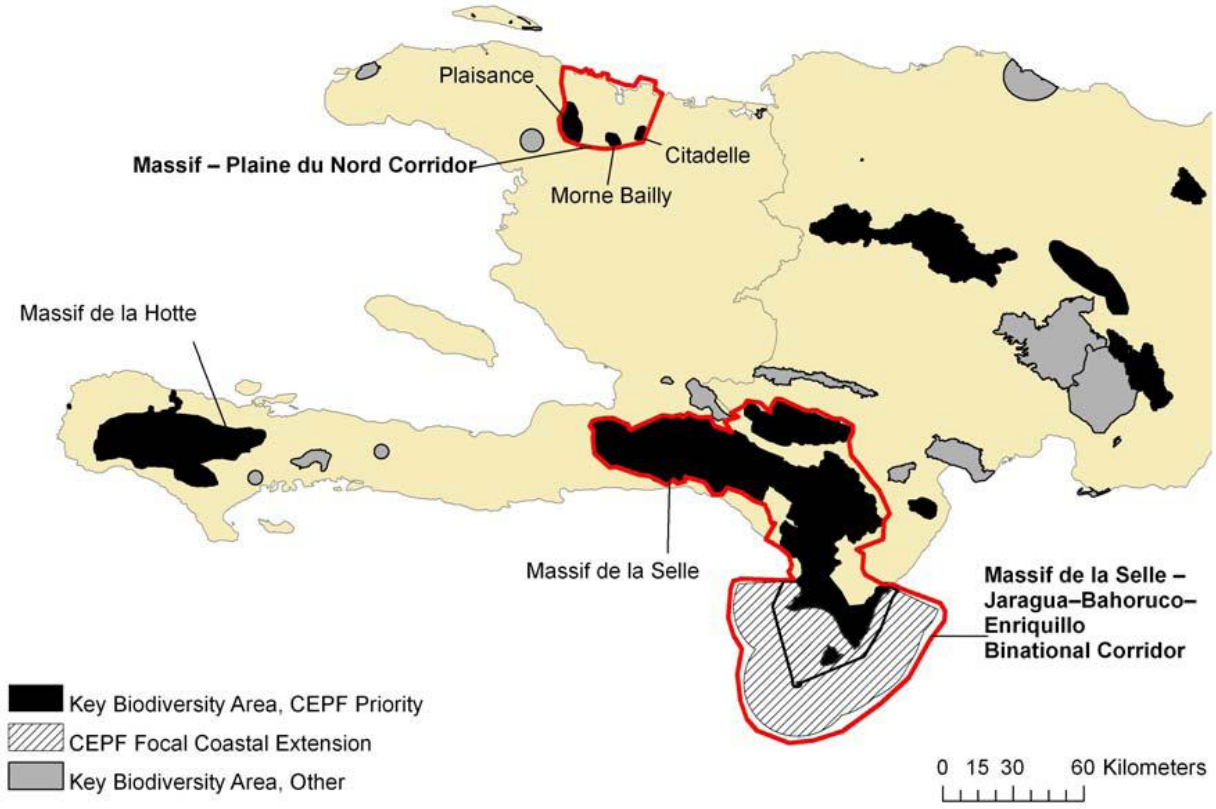

Figure 2. Key Biodiversity Areas in Haiti. Source: CEPF 2010

Haiti has a tropical climate with two main wet seasons: the northeast trade winds bring rain from April to June, and northerly winds bring drizzle from about September through November. However, the country's topography produces significant regional (and altitudinal) differences in temperature and rainfall. The resultant vegetation varies from subtropical very dry forest formations where cacti and scrub predominate (Northwest and Northeast regions), to tropical (Montane wet forest) at the higher altitudes where Hispaniolan pines (*Pinus occidentalis)* and temperate vegetation thrive. Wetlands, lakes, lagoons, estuaries and a varied coastline provide additional diversity. In 1925, Haiti was lush, with 60% of its original forest cover. Since then, 98% of Haiti's original forest is gone.

The deforestation started during French colonial times with timber harvest for revenues and land clearing for agriculture (e.g. sugar cane, coffee, and cotton plantations and later, rice fields). Foreign lumber companies continued the process after independence (Murray 1991) and there was a dramatic increase in uncontrolled cutting of trees for agricultural lands for subsistence annual crops on the hillsides. Today, cutting of trees for charcoal, the country's chief source of fuel, is a major contributor to deforestation although much of the wood is from shrub lands, secondary forests, and primary tropical forests along the border and in the Dominican Republic. In recent years, among the secondary causes of deforestation and land clearing in Haiti is the increasing demand for wood for construction (Geo Haiti 2010), which can be expected to increase with the need for reconstruction following the January 2010 earthquake. Deforestation has led to severe erosion in the mountainous areas and also periodic (but often catastrophic) flooding.

2.1 Status of Biodiversity Components

> "*In regard to the environment, Haiti has often been presented as the example of the ecological devastation of the Western Hemisphere. The country is extremely vulnerable. Its natural systems have been visibly weakened, and now seem incapable of withstanding external shocks, each one of these being more catastrophic than the last*." *Jean Marie Claude Germain, Ing. Minister of the Environment of Haiti* (GEO Haiti 2010).

Haiti's biodiversity is concentrated in the few small protected areas, as well as important ecosystems outside of protected areas that extend from coastal plains to mountain areas, including inland waters such as lakes and rivers. Marine biodiversity is found among islands, and marine and coastal ecosystems such as mangroves, coral reefs and sea grasses.

2.1.1 Protected Areas

Safeguarding ecosystems is important to ensure the conservation of biodiversity. Protected areas, as integral parts of the development process and basic tools for sustainable development, were recently integrated in the development scheme of Haiti, although from a historical perspective establishment of protected areas was pronounced during the 1920's.

Officially, the Haitian Government has identified a total of 35 protected areas covering about 6% of the nation. However, the percentage of effective protected areas, some of which are actually historical sites (Table 1), is evaluated at no more than 0.5% of the surface of the country. With the latter statistic in mind, Haiti stands far behind other Caribbean countries (EoE 2009) namely Jamaica (20.9%), the Bahamas (11.4%), Cuba (18.8%), the Dominican Republic (28.5%), Turk and Caicos (28.5%) and Martinique (63.6%). Main protected areas of Haiti include national parks, a forest reserve, historic parks, hot springs and inland waters as indicated in the USAID 2006 Haiti Analysis of Tropical Forestry and Biodiversity.

Most of the established protected areas are not generally supported by management plans and adequate resources. In general, management of protected areas in Haiti, in spite of some steps

to address the issue, is handicapped by the lack of a comprehensive National System of Protected Areas that could include different significant ecosystems of the country. The management situation depicted in the USAID 2006 analysis is still accurate.

Of the 35 protected areas recognized by legislation, only Macaya, La Visite, Forêt des Pins and Sans Souci have some form of management. In spite of the existence in legislation of protected aquatic areas such as Trou Caïman and Lake Azuei, at the present time there is not really any proper management of aquatic and marine areas (GOH 2010).

The recent Bureau de Mise en Oeuvre de l'ANAP (Implementation Office of the National Agency of Protected Areas), which in theory has control over the parks is understaffed and not fully operational in terms of planning, resource allocation, implementation, monitoring and evaluation.

Table 1. National Parks and Protected Areas in Haiti

Name	Habitat type	Size (hectares)	**Year Established**
Fort Jacques and Fort Alexandre	Historical	9	**1968**
Fort Mercredi	Historical	5	**1968**
La Citadelle, Sans Souci, Ramiers	Historical site Mountainous	2200	**1968**
Sources Cerisier et Plaisance	Hot Spring	10	**1968**
Sources Chaudes	Hot spring located 20 km north of Port-au-Prince that is known for its medicinal qualities.	20	**1968**
Sources Puantes	Hot spring	10	1968
Lac de Péligre	Man-made lake	100	**1968**
Parc La Visite	Tropical Moist Forest & Pine forest	3000	**1983**
Parc Macaya	Tropical Moist Forest & Pine forest	2000	**1983**
Forêt des Pins	Pine and Mixed forest Reserve - no legal harvest, but enforcement is lacking	5,500	

Data adapted from the World Database on Protected Areas: http://sea-bov.unep-wcmc.org/wdbpa/index.htm?http://sea-bov.unep-wcmc.org/wdbpa/toplevelindex_new.cfm~summary_tab

Unlike other nations in the wider Caribbean that have established Marine Protected Areas with varying degrees of protection for the marine environment, Haiti has not yet established a Marine Protected Area (Table 2). Efforts to assist the Government of Haiti to fill the gap in Marine Protected Areas are underway with basic studies and legal proposals to establish such areas along the Arcadins Coast (USAID/DEED Project), Baradères-Cayemites (UNEP) and in the North-Northeast Bays (Limonade, Caracol and Fort Liberté with UNDP).

Table 2. Marine Protected Areas in the Wider Caribbean

Country	Marine Protected Areas	Other	Total
Cuba	15	15	30
Dominican Republic	7	4	11
Jamaica	4	0	4
Haiti	0	0	0
St Lucia	2	1	3
Trinidad & Tobago	1	7	8
Barbados	1	1	2
Belize	2	0	2
Dominica	1	0	1
Bahamas	9	0	9
St Vincent and the Grenadines	1	0	1
Guadeloupe	1	0	1

Source: GBRMPA,WB,WCU 1995

2.1.2 Important ecosystems outside Protected Areas

Dame-Marie (Grande-Anse Department), Plaisance (Northern region), Presqu'île du Nord-Ouest I and II have been identified as three of the five Wholly Irreplaceable Sites that contain, according to the CEPF (2010) classification, the only known populations of many globally threatened species. Other important ecosystems outside of protected areas include:

Fishing Zones

Haiti produces more than 5,000 tons of fish annually. About 30,000 fishermen (Geo Haiti 2010) ply the coastal and inland waters, primarily using traditional fishing methods. Unregulated exploitation and the traditional equipment used, results in over-fishing in the coastal waters and under-fishing in the high seas. Moreover, other practices also encourage overfishing, for

example, the use of chemical products, such as insecticides and other herbicides, which are believed to facilitate the catch of fish. (Geo Haiti 2010). The territory has been divided into seven fishing zones including continental fishing (Table 3).

There are no accurate assessments of available fish stock. Potential yields of major fish resources are currently being assessed with Cuban cooperation. Fish resources fall roughly into three categories: demersal (or deepwater), shellfish and pelagic (near the surface) species.

More than 300 demersal species are recorded in Haiti's waters. In this category, snappers are commonly sought. Shellfish (lobster, shrimp, conch and other mollusks) are very popular and prized. Pelagic species are found in form of small resident populations along the southern and northern coasts of Haiti. Ornamental reef fish are illegally harvested by commercial fishermen and the tourism industry.

Shellfish species are overfished, although some of the deepwater species, such as the white shrimp and bottom crab are not as heavily exploited. Cases of overexploitation are also reported for ornamental reef fish. in some places, coral reef material is used in construction for inner and outer decoration of houses. Quarry exploitation has resulted in siltation of coastal waters and alters the health of these ecosystems.

Table 3. Fishing zones and population of fishermen in Haiti

Fishing Zones	Sites	# Fishermen
I	Derac to Cap Haitien	2,498
II	Port de Paix to Anse à Foleur including Petite Anse and Ile de la Tortue	3,268
III	Anse Rouge to Miragoâne including La Gonâve	3,453
IV	Miragoâne to Tiburon including Les Cayemites Island	12,048
V	Tiburon to Aquin	6,000
VI	Côte de Fer to Anse à Pitre	4,494
VII	Continental Fishing	1,071

Source: MARNDR Fisheries Service 2001

Significant Coastal Ecosystems

With a Coastline of 1775 km and a coastal shelf of 5000 km2 and five main offshore islands, Haiti's coastal and marine resources include examples of a remarkably varied ecology rich in biodiversity. The coastal ecosystems play a crucial role in the production and maintenance of fisheries and other biological resources of primary importance for the human population of Haiti and surrounding islands.

A rapid assessment of the economic value of ecosystem services provided by mangroves and coral reefs in Caracol Bay (north coast of Haiti) conducted by the Fondation pour la Protection de la Biodiversité Marine (FoProBiM 2009a) estimated ecosystem services for Caracol Bay are worth US $105,228,000 for mangroves and US $4,505,000 for coral reefs for a total estimated value for ecosystem services of US $109,733,000 (this total does not include ecosystem

services provided by sea grass beds). While this value is significant in itself, when one considers the 1775 km of coastline, of Haiti the value is enormous. The economic value of mangroves, coral reefs and sea grass beds along the 822 km southern peninsula of Haiti from Anse à Pitre to Grand Goâve (FoProBiM 2009b) was estimated at more than US $2.3 billion.

Along the Haitian coastline deltas, estuaries, coastal plains, and coastal lagoons are present. These wetlands provide diverse, renewable natural resources which support mixed traditional economies based on fisheries, the use of forest products and gathering. Grasslands and mangrove forests support useful plants. Coastal lagoons and mangroves are the nursery grounds for many species, both benthic and pelagic, as well as a buffer to climate change risks.

Sea grass beds, coral reefs, and mangroves constitute predominant features of the Haitian coastline. Sea grass beds occur along the north coast, Les Cayes in the south, La Gonâve, Les Cayemites and l'Ile à Vache areas. They represent a great source of primary productivity providing oxygen and nutrients to marine species and a means of stabilizing substrates.

Coral reefs are scattered along coast of Haiti. They provide food and shelter for resident and migratory species, play a protection role for coastal property from tropical storm damage and offer a storehouse for potentially valuable species (pharmaceuticals, commercial species).

Mangrove forests (137 km2 in 2005) occur on the North and North east Coast (Baie de Fort Liberté, Baie de Caracol and Baie de l'Acul), the Artibonite estuary, Les Cayes, L'Ile à Vache, La Gonave and the Grand Cayemites. They play an important role in the reproduction cycle of numerous coastal and pelagic fishes species as well provide shelter for their offspring. These species include the pike (*Centropomus undecimakis*), and crustacean species like the prawn and the lobster (*Penaeus* spp and *Panulirus argus*) or mollusks (*Strombus giga*).They are thus considered important from an economic perspective since they are at the center of the fishing industry's productivity.

The mangrove forest habitat holds a rich and diversified fauna of which some representatives are permanent residents while others are seasonal visitors. At least 13 species considered either threatened or seriously in danger of extinction have been identified as inhabitants of mangrove forests and lagoons in the country. Among them are the West Indian manatee (*Trichelus manatus*), the American crocodile (*Crocodylus acutus*), the Atlantic sea turtle (*Eretmochelys imbricata*), and the Flamingo (*Phaenicophilus palmarum*).

In 1980 there were approximately 17,800 hectares of mangroves in the coastal zone of Haiti. Ten years later, that figure dropped to 15,000 hectares, and by 2005, the most reliable estimates show 13,700 hectares of mangroves remaining (GEO Haiti 2010) a decline of 39 percent in 25 years.

Along the northeast coast of Haiti, particularly from Fort Liberté to Bas Limbé, there are still extensive mangroves, sea grass beds, and coral formations. The coastline near Labadie, west of Cap Haïtien receives some protection because of the management of the area associated with the cruise ship tourism industry. At Bas Limbé, the local community leader has issued a decree that the mangroves are to be protected. Local people are no longer cutting and are

volunteering to be guards. There is a nursery and a restoration area in which young mangroves were planted (Figure 3). Grazing is still a problem and may affect the survival of the plantings.

Figure 3. Mangrove plantation at Bas Limbé. Photo credit: Scott Posner

The Fondation pour la Protection de la Biodiversité Marine (FoProBiM 2009a) recommended Caracol Bay of northeastern Haiti for coastal and marine protected areas. Caracol Bay contains a large expanse of mangroves as well as a fringing coral reef. There are several fishing communities harvesting marine resources in the bay, and the exploitation of mangroves occurs not only by these fishing communities but also by other communities located further inland.

The Arcadins coastline, north of Port-au-Prince and south of St. Marc, historically had extensive mangroves, sea grass beds and coral reefs. While many areas along the coast have suffered severe degradation, there are still sufficient areas of intact habitat to provide vital nursery areas for area fisheries (FoProBiM 2008) and have drawn support for a proposal submitted by the DEED project to develop a Marine Protected Area. DEED staff submitted a draft decree to establish a Marine Protected Area for consideration by the Ministry of Environment in 2009, but this proposal has not been acted upon and post-earthquake actions are now taking priority for the MDE.

The coastal and marine ecosystem in the vicinity of Les Cayes (northwest portion of the southern peninsula of Haiti) is being targeted for a Marine Protected Area with two areas of

strict protection. There are vast sea grass beds and well-developed coral reef systems, flamingo and crocodile habitats, as well as a scenic landscape around St. Louis du Sud. This area has a potential of 100,000 tons of shrimp (USAID 2006), however intensive fishing is threatening the marine ecosystem.

The area around Baradères Peninsula and Cayemite Islands (southwest portion of the southern peninsula of Haiti) is also important for biodiversity and has been identified by UNEP and others as warranting designation as a Marine Protected Area. This area has a pristine coral reef system and relatively large untouched mangrove formations.

Inland Aquatic Ecosystems

There are 30 watersheds in Haïti. More than 100 streams flow from the Haitian mountains into the Golfe de la Gonâve, the Atlantic Ocean, and the Caribbean Sea (ACOE 1999). In the highlands, streamflow is rapid and torrential and some have spectacular waterfalls, such as Cascade Pichon at Belle-Anse, Saut-d'Eau in the Central Plateau and Saut Mathurine at Camp-Perrin (Geo Haiti 2010). Waterfalls and other barriers inhibit upstream migration of fauna and may contribute to the isolation and endemism of some of the species, although barriers can also fragment populations and increase the risk of local extirpations.

Many streams and tributaries, especially in the lowlands, have their flows dissipated by evaporation and infiltration and only reach the sea during floods (ACOE 1999). As hillside erosion increases sedimentation deposition, many streams and even segments of some rivers that formerly flowed year-round are becoming subterranean waterways with only intermittent surface flows. Sedimentation fills interstitial spaces in stream substrates, eliminating important spawning habitat and cover for fish and other aquatic organisms, while lack of surface flows may eliminate most of the aquatic obligate species.

The Artibonite River is Haïti's largest waterway running 280 km through a 9,500 km^2 watershed. Other large streams include Les Trois Rivières, Rivière Grand'Anse, and Rivière du Massacre (or Rio Dajabon), and Rivière Pédernales. The Trois Rivières is the second longest stream and discharges into the Atlantic at Port-de-Paix. The Rivière Grand'Anse has the second highest discharge and reaches the coast near Jérémie on the southern peninsula. The Rivière du Massacre and the Rivière Pédernales begin in the Dominican Republic and form parts of Haiti's border with the Dominican Republic before flowing into the Atlantic Ocean and Caribbean Sea, respectively (ACOE 1999).

The Lac de Péligre (Lake Peligre) is a manmade reservoir on the upper Artibonite River. Completion of the dam formed a massive reservoir covering 2,750 hectares and allowed some control over the flow of the Artibonite River, which had previously fluctuated between a raging torrent and an uncertain trickle. The Lac de Péligre, which covers an area of about 30 square kilometers, has lost about 30 percent of its storage capacity (ACOE 1999). As the lake fills with sediment, aquatic habitat is lost, and while this reduces the amount of sediment flowing to the lower reaches of the river, significant sediment loads are still being deposited downstream due to erosion in the lower watershed.

Numerous natural lakes and ponds are scattered from the high mountains to the lower floodplains, adding to the rich biodiversity of Haiti. Many of the natural lakes that exist throughout the country contain brackish water, which adds to the diversity of inland aquatic species. Numerous ponds and lakes occupy sinkholes in limestone terrain. Some of these lakes are permanent while others are intermittent (ACOE 1999).

The largest natural lake in the country is Lake Azuei or Étang Saumâtre at the eastern end of the Cul-de-Sac watershed. It covers an area of about 181 square kilometers, has no outlet, and contains brackish water (ACOE 1999). Mangroves growing on the north-western side are a remnant of the coastal vegetation of a shallow sea that separated Hispaniola into two Paleo-islands during the Pleistocene. The lake and adjacent wetlands have been designated an Important Bird Area (Birdlife International 2010). This IBA supports up to 300 of the Near Threatened Caribbean Coot *Fulica caribaea*. Flocks of up to 100 Caribbean Flamingo *Phoenicopterus ruber* are present along with good (but unknown) numbers of waterbirds and shorebirds. The Vulnerable American crocodile *Crocodylus acutus* occurs, and the lake supports five endemic species of fish and an endemic turtle. The nearby Trou Caiman Lake is smaller, but it is also brackish and has been designated as an Important Bird Area since it supports a similar variety of important fauna.

Lake Miragoâne (1,130 hectares) is located on Haïti's southern peninsula. The lake has eight endemic species (MacLennan 2008), including the Haitian mosquitofish (*Gambusia beebei*) and seven species of titis (the Haitian name for *Limia* fish), that scientists have found to meet the criteria to be considered Critically Endangered by the IUCN Redlist (although they have not yet been officially assessed for the scientific record). The land surrounding the lake – its watershed – is almost completely deforested. Unfortunately, that nearly treeless landscape is only one cause of the lake's dirty water. In an area with almost no treatment of human waste, Lake Miragoâne exhibits the highest coliform counts measured in Haiti. This is a human health issue and a threat to the fish.

Bois Neuf Lake is the only freshwater lake in the Montrouis watershed, fed by the Roseau River and upstream marshes that have been converted to irrigated gardens. It is home to a large diversity of resident and migratory waterfowl, aquatic vegetation communities and numerous endemic fish, amphibians and reptile species (Timyan 2008).

Lagon-aux-Boeufs is a brackish lake on the coastal plain of Dauphin, northeastern Haiti, just east of Fort-Liberté. The lake is fringed with mangroves and xerophytic shrubland set within the otherwise agricultural coastal plain. Large numbers of migratory ducks and shorebirds use the site which supports a population of Caribbean Flamingo *Phoenicopterus ruber*. This Important Bird Area (Birdlife International 2010) supports an important population of the Vulnerable West Indian Whistling-duck *Dendrocygna arbore*a. Lagon-aux-Boeufs is state owned but unprotected. The area was included within a biosphere reserve nomination, and the Ministry of Environment identified the area as in need of protection (and as a recreational area) within a departmental environmental action plan, but no conservation action has been implemented. Approximately 20,000 people live around this wetland, living on fisheries, agriculture, charcoal production and occasionally boat rides.

Freshwater springs are sometimes protected for the valuable potable water they provide. In the eastern Cul de Sac Plain, at least 17 springs, such as Source Zabeth, are being protected, resulting in small parcels (up to 4 ha) of relic tropical forest and habitat for native terrestrial and aquatic species. These small parcels provide a genetic reservoir of native species that could be used to repopulate adjacent areas if ecosystem restoration projects were initiated.

2.1.3 Species diversity and species at risk

The following information has been updated from the USAID 2006 report to describe the species richness and species at risk in Haiti. Of special interest, in the four years since the 2006 report, nine new species of amphibians have been added to the recorded fauna of Haiti (Table 4). The Caribbean is an internationally recognized biodiversity hotspot, and is one of the world's greatest centers of endemic biodiversity as a result of the region's geography and climate: an archipelago of habitat-rich tropical and semi-tropical islands tenuously connected to surrounding continents (CEPF 2010).

The Alliance for Zero Extinction (AZE 2005) is a joint initiative of 52 biodiversity conservation organizations aiming to prevent extinctions by identifying and safeguarding key sites, each one of which is the last remaining refuge of one or more Endangered or Critically Endangered species. AZE has recognized the Massif de la Hotte in Southwest Haiti as harboring the highest number of AZE species in the world with 13 Critically Endangered species found nowhere else (42 globally threatened species occur within the key biodiversity area).

Table 4. Species diversity and conservation status of major taxa in Haiti

Taxa	# Species	# Critically Endangered	# Endangered	# Vulnerable
Amphibians	56[1]	31	10	5
Birds	245	1	4	10
Fish	184	2	1	8
Mammals	25	1	1	2
Reptiles	115	4	2	3
Plants	5242	5	6	18

Data from: IUCN Red List http://www.redlist.org and WRI http://earthtrends.wri.org.

[1]Supplemental Data from: Caribherp, http://www.caribherp.org

FLORA

Haiti is one of the richest countries in the Caribbean in terms of botanical diversity. The Haitian landscape hosts, according to the Holdridge classification based on climate factors, a total of nine zones which supports that diversity. The geologic history of Hispaniola characterized by repeated changes in sea level and the highly varied geomorphology provides a wide range of abiotic factors that favor habitat diversity and have given rise to significant local endemism.

Certain botanical families are particularly rich in endemic species, notably the Orchidaceae, Melastomataceae, Rubiaceae, Flacourtiaceae, Poaceae, Urticaceae and Asteraceae (Hilaire 2000). Other families, such as the ferns and allies show a much lower level of endemism. Very little is known of the basidiomycete fungi, though investigations conducted in the DR indicate high endemism among the saprophytic fungi families of the moist and wet forests (Lodge 2000).

In spite of severe environmental degradation problems in Haiti, Hispaniola has the second most diverse flora in the Caribbean, after Cuba. Floristic studies among the vascular plants invariably reveal new species to science, particularly in biological rich areas. According to a floristic study conducted by the University of Florida in the 1980s and 1990s, an inventory of orchids of Macaya National Park (in the Southern Peninsula) revealed that a third of 134 species were undescribed at the time of their collection. The total orchid flora, occupying less than 10 km^2, represent roughly 40% of the three hundred fifty orchid species known to exist on Hispaniola (Dod 1993; Hespenheide & Dod, 1993).

The *Flore d'Haiti* (Barker and Dardeau 1931) suggests that over 5,365 vascular plant species were found in Haiti in the early 20^{th} Century. It has been estimated that among these plants, 37% are endemic comprising approximately 300 species of Rubiaceae, 300 species of Orchidaceae, 330 species of Asteraceae, 300 Graminae and three species of Conifers (*Pinus occidentalis, Juniper juniperus, Juniperus ekmanii*).

FAUNA

Haiti boasts a rich fauna as well, of which 75% are considered endemic. The mainland and satellite islands reflect a high degree of endemism.

Mammals: There are 25 native mammal species in Haiti. Two native mammals of special significance occur in Haiti: the critically endangered Haitian Hutia (*Plagiodontia aedium*) and the endangered Giant Island Shrew: the Nez long (*Solenodon paradoxus*). Both are likely extirpated over much of their native range. The possibility of *Isolobodon* sp, a rodent, and *Nesophantes* sp, an insectivore, occurring on Ile de la Tortue (Tortuga Island) remains unconfirmed.The highest diversity among the native mammals in Haiti are bats. There are fifteen species of which seven taxa, including species and sub-species, are considered endemic. The remainder of the native mammal diversity is aquatic and includes the West Indian Manatee (*Trichecus manatus*), the Pygmy Sperm Whale (*Kogia breviceps*), the Pilot Whale (*Globicephala macrorhynchus*) and five Dolphin species.

Birds: According to Birdlife International, the Republic of Haiti supports over 245 species of birds, of which more than 73 are resident landbirds. The Hispaniolan avifauna exhibits exceptional levels of endemism. The island is an Endemic Bird Area (EBA), and 36 range restricted species are known from Haiti, one of which, the grey-crowned palm tanager (*Phaenicophilus poliocephalus)* is endemic to Haiti. The majority of the range restricted species are confined to, or occur in habitats above 1,000m, emphasizing the importance of mixed montane broadleaf-pine forest.

Ornithological fields observations conducted by US scientists from Vermont Institute and Cornell University in Macaya and La Visite Parks confirm the exceptional diversity of birds in these areas in spite of threats posed by habitat loss and fragmentation. At three sites in the Macaya Biosphere Reserve (Pic Macaya, Pic Formon and Rak Bwa), 41 species were recorded among 188 mist net captures, 41 point count detections and 461 total observations. These included 13 North American migrant species and 28 permanent resident species of which 11 were Hispaniolan endemics (Rimmer et al. 2006). Those scientists documented in Macaya the first record of Swainson's Warbler for Haiti. At two sites in the La Visite (Pic Macaya, Pic Formon and Rak Bwa), 50 species were recorded among 182 mist net captures, 79 point count detections and 476 total observations. These included 12 North American migrant species and 38 permanent resident species of which 14 were Hispaniolan endemics (Rimmer et al. 2005).

Ten Important Bird Areas (IBA) covering 232 km^2 (less than 1% of Haiti's land area) have been identified and represent the country's international site priorities for bird conservation. Five of the IBAs are within embryonic protected areas: Massif de la Hotte, Massif la Selle, Massif du Nord. More than 155 species of water birds are found in Haiti and key water bird sites include the Lagon aux boeufs near Fort Liberté; Acul Bay near Cap Haïtien; Ile de la Tortue in Basse-terre; Étang Labored-lachaux near Camp-Perrin; and Coquillage, Petit Paradis, Artibonite Delta, Étang Bois Neuf, Sources Puantes, Étang de Miragoane, and Baradères-Cayemite mangroves.

Reptiles and Amphibians: The isle of Hispaniola is known to host 217 species of reptiles and amphibians (Thomas 2000). Approximately 70% of this diversity has been recorded in Haiti. Ninety eight percent (98%) are endemic to Hispaniola with about a third of the species occurring only in Haiti. Five sea turtles, according to *Ottenwaldder* 1996, have been inventoried in Haiti. They are: *Eretmochelys imbricata* (found in Anse à Pitres, Ile à vache, Côtes de fer), *Caretta caretta* (found in Belle Anse, Cayes-Jacmel, Anse à Pitres), *Dermochyles coriace* (found in Tiburon) and *Lepidochyles olivacea*. Two terrestrial iguanas are recorded: *Cyclura cornuta* and *Cyclura ricardi*. The American crocodile, also known as the Caïman is also found in Haiti.

Haiti harbors an exceptional fauna of terrestrial frogs. From 49 *Eleutherodactylus* species described for Hispaniola, 20 species come from Castillon, a small village located North to the *Massif de la Hotte* and close to the small city named Leon. The *Massif de la Hotte* is known to host the most diverse frog species in the Caribbean. At least 26 *Eleutherodactylus* species have been recorded. Two species new to science that were recently *discovered in Haiti are:* ***Mozart's Frog****, Eleutherodactyles Amadeus (Plaine Formond/Macaya Park) and* ***Macaya Breast-spot frog,*** *Eleutherodactyles thorectes* (*the smallest species known from Hispaniola and* the genus). Unfortunately, 46 of the 56 species of amphibians in Haiti are at risk (Table 4), some at the verge of extinction.

Fish: Most of the 184 fish species in Haiti are marine species. Of the approximately 41 freshwater species, about 25% are endemic, while about 10% are introduced carp and tilapia (Froese and Pauly 2010). Inventory and monitoring of the native fish of Haiti is incomplete and it is likely that the number of vulnerable species is greater than that shown in Table 4.

Invertebrates: Considering the incomplete inventory and knowledge of vertebrate species, it is not surprising that most of the diversity represented by invertebrates is unknown to science or insufficiently studied in Haiti. Since invertebrates contain the highest diversity at the species level, it is reasonable to argue that most of the biodiversity of Haiti remains largely unknown.

2.2 Status and Management of Forest Resources

For purposes of this analysis, a broad definition of forestry will be used. This will include not only traditional forestry, such as production of timber from closed forest, but also management of closed forest for other resources, such as water, wildlife and recreation; management of open forest and savanna for production of fuelwood, conservation of soil and water, and grazing; and agroforestry in which trees are planted on farms in association with crops. Forestry ecosystems include dry-scrub forests, savannas and moist forests on peaks reaching almost 3,000 meters. Leslie Holdridge, a great American ecologist developed his ecological life zone concept while working in Haiti during the 1940's. An example of the type of vegetation that would be expected to develop in an unaltered condition was described in the previous assessment (USAID 2006).

Haiti's endowment of forest resources has been treated as a free good and exploited to capitalize economic development since colonial times. Europeans cleared mountain forests to establish coffee plantations and used clean-tilling agricultural practices that promoted soil erosion. European colonists and then, later, Haitian governments harvested and exported timber (chiefly mahogany, ironwood and logwood) to earn hard currency. Haiti's peasants, especially the land-poor, have historically cleared forest to expand agriculture. Peasants also exploit forest stocks in time of economic insecurity or to finance unexpected contingencies. In several situations, the unsustainable exploitation of trees or forest is the only remaining income-generating option available to peasants. In fact, forests (or former forest land) are everything to the Haitian peasant: space to grow annual crops, engage in animal husbandry, extract useful products, and a last ditch store of capitol. These values were well documented in a study supported by the World Bank in 1996 dealing with perceptions of the Forêt des Pins Reserve by local peasants.

Haiti's forest cover was 90% in pre-Columbian times and 60% in 1923. The current amount of forest cover in Haiti is not precisely known, estimates range from 1.5% to 2.6%. In general, it is estimated that 16% of the national territory is completely devoid of vegetation (Geo Haiti 2010).

Geo Haiti (2010) highlighted a 53% reduction in 2000 of the existing forest area in Haiti before 1990. The reduction was only of 11% during the same period in the other regions of Central America and the Caribbean. It also showed that, in addition to being reduced, the areas covered by vegetation are excessively exploited. In Haiti it is estimated that, considering soil, climatic and slope characteristics, 55 percent of the land area should be maintained in permanent forest. In 1990 only 600 square km were under dense forest cover, which represented only four percent of what should be forested, or 2.2 percent of the land area. Table 5 presents the types of vegetation and their coverage in percentage in Haiti.

Although some shrublands are now being managed for sustainable production of wood for charcoal, virtually no scientific management of forests is practiced in Haiti. Some potential may exist for managing the once dense pine forest for sustained timber production at Forêt des Pins, but for the near to mid future this is unrealistic.

Table 5. Types of vegetation and their coverage (%) in Haiti

Types of vegetation	Percentage of Haitian territory
Agroforestry	18.3
Forests	2.6
Intensive cultures	44.1
Wetlands	1.4
Mangroves	0.7
Undergrowth	31.8
Pasture	1.1

Source: Hilaire 2005 cited by Geo Haiti 2010

In 1982, available wood stock was estimated to be 37.4 million cubic meters (BDPA 1982) with about 6 million cubic meters used for construction, building sector, and other purposes. This consumption is equivalent to approximately 30 million trees annually harvested.

At the same period, it was estimated that 20 million trees were planted with a survival rate of about 40% (ESMAP 1991). The reforestation capacity was estimated at about 26% of the consumption (equivalent to 1.6 million cubic meters) while the annual capacity of self reproduction of natural wood without new plantations was also evaluated to 1.6 million cubic meters. Thus the total regeneration capacity was roughly 52% of consumption.

Bearing in mind those figures and assuming they are reliable, it should have held that in 1990 the country would have had less than half of the wood stock of 1982 that is to say 18.6 million cubic meters. However, in large part due to the embargo of 1986 to 1990, the stock was much less - 8 million cubic meters - and had reduced to 7 million cubic meters by 2000 (FAO Global Forest Resources Assessment 2005). Since that time forest stock depletion has slowed. However, if such trends were to be continued without any corrective action, it is not too pessimistic to forecast complete depletion of that resource in a near future. It is estimated that between 30 and 50 million trees and shrubs are cut annually (CEPALC 2005).

The direct consequences of deforestation are severe and very costly to the Haitian economy. The destruction of the forest has resulted in accelerated soil erosion. It is estimated that 2,000 ha of arable lands with a depth of 20 cm are washed away every year after the removal of the forest cover. These 2,000 ha would have produced on average 8 million USD of various agricultural products. Although soil erosion is present in almost all regions of the country, some are more severely affected than others. Regions such as Grand'Anse, Southeast, West, Artibonite, North and Northeast, are at risk of very severe erosion (Geo Haiti 2010).

Another consequence of this phenomenon is exemplified by the situation of the Péligre dam which provides nearly the totality of the hydroelectric power of the country. The dam has already lost 70% of its 47MW capacity as a result of siltation. At that current rate it is estimated that its production will be nil in 2018. CPALC (2005) estimated that the environmental cost of using wood in Haiti would be 1,600 million USD in 2003, which is 18 fold greater than the 88 million USD of savings in imports of petroleum fuel (which would have been used instead of wood).

According to a national land use capability determination for Haiti, only 30 percent of Haiti's land area is appropriate for agriculture, and over half of that needs special conservation practices. Soil erosion caused by inappropriate agricultural practices not only reduces the productive potential of hillside farms, but has tragic downstream consequences. Removal of tree cover exposes soil to the erosive impact of water and wind. Additionally; the annual input of organic matter to the soil from litter is lost. With less organic matter, the infiltration of rainwater is diminished. Soil loss results in reduced capacity of watersheds to store water. As a result of these two phenomena, the hydrologic cycle is changed, and river levels rise to dangerous levels quickly after heavy or prolonged rainfall (tragically exemplified by devastating floods at Fond Verette, Mapou, and Gonaives). Conversely dry season flows are reduced drastically, with negative impact on irrigation projects and well levels. Thus, watershed deterioration reduces the productive potential of both hillside and valley farms, and increases flooding. This degradation of drainages also has a negative impact on biological diversity, as sediment in rivers smothers coral reefs and sea grass beds.

FUELWOOD AND CHARCOAL

Forest resources provide the most important sources of energy in Haiti in the form of fuelwood (rural) and charcoal (urban) which accounted for 75% of the final energy consumption by all sectors in the year 2000 (Bureau des Mines et de l'Energie). Charcoal is used by 90% of the households from Port-au-Prince and other major cities and the sub-sector employs more than 150,000 persons. The contribution of these products to the rural economy is very significant. Charcoal is made in nearly all rural areas of Haiti, and about 20 percent of the selling price remains in the rural economy (ESMAP 2005).

Charcoal is made from trees with a low conversion efficiency of about only 20% (5 kg of wood for 1 kg of charcoal). Fuelwood consumes 4 million metric tons per year, a volume four-fold greater than what could be produced under a sustainable management of forest resources (CEPALC 2005). Fuelwood and charcoal represent 9% of Haiti's GDP, allowing a saving of 88 million USD in imports. However, their consumption is one of the main causes of recent past and current deforestation in Haiti and has other indirect costs as was discussed above in relation to the Péligre Dam.

Most charcoal is produced from land that has limited agricultural potential, since almost all arable land is already deforested and occupied. In the northwest peninsula and the Ile de la Gonave charcoal production is an important source of cash revenue to farmers, since the poor

soils there do not allow sufficient crop production for the sale of surpluses (FAO I987). The preferred charcoal species is Lignunm vitae, or Gaiac (*Guaiacum officinale*), but today this species is very rare. Mesquite or Bayahonde (*Prosopis juliflora*) is the second preference. These species generally sprout after being cut, producing multiple stems; however, management systems for these scrub forests are not well defined and though local sustainable production is sometimes practiced it is not well understood nor widely used. Table 6 provides a list of species used for heating and charcoal in Haiti.

Charcoal production by Haitians has been occurring within the Dominican Republic along the border, especially in Sierra de Baruco National Park which holds some of the most abundant biodiversity on the island. This charcoal production is a well organized business and provides Haitians up to 250 Gourdes (approximately US $6.25) a day. Although the Government of the Dominican Republic has taken action to reduce the illegal charcoal harvesting, it still is occurring on a large scale as of 2010, Thus, the thirst for charcoal by Haitians for cooking fuel has had a negative impact not just on Haiti, but also on neighboring Dominican Republic. Without alternatives for sustainable livelihood activities or alternative cooking fuels, it is anticipated that the cutting of both tropical hardwood forests and shrubland habitats will illegally continue in both countries.

Table 6. Some heating and charcoal wood in Haiti

Local name	**Scientific name**	**Family name**
Bayahonde	*Prosopis juliflora* (SW.) P. DC.	Leguminoseae
Acacia	*Acacia lutea* (Will) Briton	Leguminoseae
Bahonde rouge	*Acacia tortuosa*	Leguminoseae
Bois cabrit	*Cassia emarginata* L	Leguminoseae
Saman (Gouane goul)	*Euterolobium saman* (Jacq.) Prain	Leguminoseae
Tcha-tcha	*Albizzia lebbeck* (L) Benth	Leguminoseae
Casse	*Cassia grandis* L	Leguminoseae
Bois de satanier	*Cupania americana* L	Sapindaceae
Bois chandelle	*Ameris balsanifera* L	Rutaceae
Petit bois blanc	*Schaefferia frustescens* Jacq.	Celastraceae
Bois de lance	*Oxandra lanceolata* (SW.) Baill.	Annonaceae
Manglier rouge	*Rhizophora mangle* L	Rhizophoraceae
Manglier blanc	*Laguncularia racemosa* (L) Griseb.	Combretaceae
Mangle ou Palétuvier	*Conocarpus erecta* L	Combretaceae
Manglier noir	*Avicennia nitida* Jacq.	Verbenaceae

Source: Haiti 2000: Bois et Reboisement. Claude Pierre-Louis 1986

Traditional charcoal stoves have a 20% use efficiency whereas liquid petroleum gas (LPG) stoves have a 55% efficiency. Pilot experiments that started in the 1980's to promote the use of improved charcoal stoves were not successful. In 1998 a program funded by USAID developed a more efficient charcoal stove called *Recho Mirak* able to save 40 to 50 percent of the energy used for cooking. Some households reported that charcoal consumption decreased from five 35 kg bags of charcoal per month to three bags per month by using *Recho Mirak*. The improved cooking stoves presented other significant advantages including reduction in cooking

time, ease of use, and reduced health dangers. Factors that allegedly limited wider distribution of the *Recho Mirak* included a poor marketing plan, dependence on the external market for supply of the raw material to manufacture the stove, and its high price compared to traditional charcoal stoves. Other, later trials had success at a limited scale, but widespread adoption of improved stoves has not been achieved to this date.

Several actions undertaken in the past 15 years to reduce the pressure on forest resources by promoting the use of kerosene have not been successful. According to CEPALC 2005, six main obstacles to the shift from plant fuel to petroleum fuel by Haitian households have been identified: the cost of equipments using petroleum fuel is too high; kerosene is not well accepted by rural households; the government does not have the means to facilitate the transition from plant fuel to petroleum fuel; the diminution of the activities in the wood sector resulting from a decrease in the energy demand would take away an essential source of income from a large part of the population; the decrease in wood demand would result in an increase in the price of petroleum fuel; and Haiti lacks an institutional framework to promote the transition process from plant based fuel to petroleum products.

Efforts have also been made by the Mining and Energy Bureau (BME), to convert the wood based laundries and bakeries to alternative sources of energy, such as diesel. One of the main limitations to these efforts is often the lack of access to credit by the small businesses. It is important to bear in mind that all the efforts mentioned above have not brought about any conclusive results, due to institutional problems and the absence of fiscal and legal incentives" (MDE/BME, 2003 cited by Geo Haiti 2010).

The USAID-WINNER project recently launched (in partnership with the Ministry of Environment, and a Haitian propane gas cook-stove manufacturer and supplier) a pilot project to help food street vendors switch from charcoal to gas cook-stoves. These stoves are being used by 85 street vendors who have agreed to stop using charcoal. The program goal is to reduce the demand for trees for charcoal. Each stove is reducing the demand for charcoal by 2,000 bags per year. For the entire pilot program this amounts to 200,000 bags per year.

WOOD FOR CONSTRUCTION

Another important cause of widespread deforestation and land-clearing in Haiti is the demand for wood in the construction sector. Wood is used primarily as struts and facings in construction. Table 7 presents the production and consumption of fuelwood, industrial roundwood, and sawnwood in Haiti from 2000 to 2006.

Table 7. Production and consumption of wood resources from 2000 to 2006 in Haiti

Woodfuel	Industrial Roundwood	Sawnwood
1,000 m^3	1,000 m^3	1,000 m^3

Year	Production	Consumption	Production	Consumption	Production	Consumption
2000	1964	1964	239	240	14	33
2004	1993	1993	239	240	14	33
2006	2008	2008	239	240	14	36

Source: FAO, State of World's Forests 2003, 2007 and 2009.

AGROFORESTRY

Vast areas of Haiti have soil characteristics that theoretically favor permanent forest cover to prevent erosion and promote the infiltration and storage of rainwater. These steep lands have been invaded and brought into cultivation due to the growing need for new lands to crop resulting from population growth and the equal division of land among children leading to smaller and smaller farm plots. Agroforestry offers a potential for stabilizing land in these areas. Roots of trees help to stabilize the soil, and their foliage breaks the erosive impact of rain and wind. The water infiltration and rainwater storage is improved by the incorporation of organic matter from tree leaves and decomposing roots. Trees also contribute to farm economies by producing forage, fruits, medicines, fuelwood and building materials. In many cases, surplus tree production can be traded off-farm for cash or goods not produced on the farm. Trees are also valuable for producing shade for livestock and crops such as coffee that are commonly grown under partial shade.

The USAID Agroforestry Outreach Project (AOP) and Agroforestry II were very successful from 1981 to 1991 in introducing trees into Haitian farms as a cash crop, and the demand for trees in areas where the project worked was generally greater than the supply (Lantagnge 1987). The projects resulted in the planting of more than 45 million seedlings by more than 200,000 peasants between 1982 and 1990. In at least one instance a local cooperative continued operations after the USAID programs ended.

The USAID Productive Land Use Systems Project (PLUS) from 1992-2000 planted nearly 18 million wood trees including valued native species and some exotics. Early PLUS plantings (1993) are entering significant stages of harvest for fast growing hardwoods such as Cassia. PLUS wood plantings in the 1990s may well double the rate of biomass production of early AOP plantings (Smucker 2001).

There are various ways to incorporate trees into a farming system. Trees can be planted in groups, or disbursed uniformly. They can be grown simultaneously with crops or sequentially. The USAID AOP and Targeted Watershed Management projects also examined ways to improve food crop yield in association with specific tree species. Coffee, cacao and certain other crops are traditionally managed under partial shade to achieve an optimal balance between crop production and the production of products from the shade trees. The USAID Coffee Cooperative Development project promoted shade tree management and some coordination of foresters within the AOP and TWMP was achieved.

The USAID DEED project, which began in 2008 aims at: improving agroforestry systems using a wider diversity of species, improve germplasm and management techniques associated with important cash crops and staples, strengthening farmer's capacity to manage their natural resource base sustainably, and expanding opportunities for sustainable agricultural intensification and regional agricultural enterprises based on changes in land use strategies.

Some of the agroforestry systems implemented by USAID DEED include:

***Cacao under shade**:* In this system high canopy timber species with narrow and light crowns are favored to maximize the commercial value of the bole. Fruit trees that do not exceed 20% of the total canopy area (such as *Persea Americana*, Citrus, or *Mangifera indica*) and offer an off-season source of income are selected. Palm species are selected for their economical importance and ideal architecture, whereas nitrogen fixing tree species are selected to maintain soil fertility and are easily managed by pollarding to provide light to cacao. DEED is focusing efforts to increase cacao production and quality by providing training in better management practices, introducing improved cacao varieties, better drying methods, and the selection of trees for specific economic and ecologic traits.

***Coffee under shade**:* Coffee produced in Haïti is primarily grown under the shade of mature trees. Like in the case of cacao, the economically important tree species include high-value timber, commercial fruit food staples that supplement income from coffee.

The USAID WINNER project is designed to implement wide scale investments in sustainable natural resource management to produce positive landscape level reductions in environmental, infrastructural and economic vulnerability in the Cul de Sac, Cabaret, Gonaives/la Quinte and other selected watersheds. WINNER uses a farmer-centered approach, while giving tangible support for good governance at the national level. WINNER is promoting several public private producer partnerships such as partnerships between mango producers of La Branle and mango exporters, and between coffee producers Rébo and Wiener and local farmer associations of Belle Fontaine. In the coffee partnerships, producers provide coffee plants from their nurseries and establish contracts with the farmer associations. WINNER supports this partnership by assisting farmer associations with planting coffee under shade trees, providing training on best production practices, and supporting the implementation of coffee washing stations in Belle Fontaine.

WINNER has launched a reforestation campaign and identified sites for the installation of nurseries in Petion-Ville and Kenscoff. The project has identified tree species with economic values well adapted to the agro-ecological conditions of the Kenscoff area, with the principal species being avocado and citrus.

For the implementation of nurseries, the project has trained selected staff, procured materials and equipment, identified suitable sites for the nurseries, mobilized local authorities and farmer associations, selected the tree species that will be used in the reforestation program (including a large proportion of fruit trees), and identified the areas to be planted in the hillsides of the Cul-de-Sac watershed. WINNER has identified the Fédération des Groupements Paysans de Belle-

Fontaine (FGPB) as the key community based organization that will work on reforestation activities in the Belle- Fontaine area.

2.3 Main Threats to Biodiversity and Tropical Forests in Haiti

The deforestation of Haiti and subsequent land uses have been and continue to be the greatest threats to biodiversity in the country. Deforestation has been occurring for centuries and the forest habitat has been diminished to the point that many species of plants and animals have gone extinct, others are critically endangered and others are in the precarious position of having such limited habitat that a single event, such as a storm or disease could reduce habitat and numbers to the point that the populations will no longer be viable.

No comprehensive Forest Policy has been formulated for Haiti. There is a series of laws and decrees that relate to forestry or woodcutting; however, enforcement of existing laws is essentially non-existent. Since most tree cutting is for charcoal production (see page 21, above), even small trees and mangrove forests can be used, further reducing important habitats and ground cover.

Once an area has been deforested, it is usually cultivated. Even the steep hillsides are farmed, resulting in erosion, which in turn lowers infiltration and water holding capacity, thereby increasing runoff and exacerbating the rate of further erosion. According to USAID estimates, an estimated 15,000 acres (61 km2) of topsoil are washed away each year, with erosion also damaging other productive infrastructure such as dams, irrigation systems, roads, and coastal marine ecosystems. (USAID Activity Data, Sheet 1999). As the soil is washed down the slopes, the land becomes unproductive and peasant farmers turn to other areas to grow crops, continuing the cycle.

As the sediment enters streams and rivers, fish habitat is degraded or lost. Segments of some rivers have become so filled with sediment that surface water no longer flows for significant portions of the year. These impacts are compounded by diversions of water for irrigation and domestic uses. The changes in river flows have increased the risk and severity of flooding in the lower reaches of rivers. Entire towns have virtually been washed away and riparian habitats lost.

When the rivers flow into the sea, carrying tons of sediment, important marine habitat and fauna are affected or lost. Sediment can cover or reduce the light reaching coral reefs, killing the living formations. Bottom dwelling species lose their habitat as the substrate changes, altering the entire ecosystem.

The rivers, lakes, and marine ecosystems, already stressed by sediment flows and habitat changes are further affected by unsustainable human exploitation. According to FoProBiM et al (2002), the law stipulates the conditions under which fishing activities in Haiti must be carried out. Nevertheless, “the lack of means to enforce it” contributes to a large extent to the situation. The CARICOM Fisheries Unit (Mateo and Haughton 2003) found that although monitoring, surveillance and enforcement of fisheries regulations are among the specific functions of the Fisheries Service, there is generally no action on those functions due to lack of resources and equipment, limited

organizational capacity, lack of personnel, poverty and political instability. Normally, no action is taken when violations of regulations are discovered. Substantial strengthening of the administrative and enforcement capability of the Haitian Fisheries Service is also needed before it can effectively monitor and have any real impact regulating the fisheries.

Other practices resulting in overfishing and habitat degradation include the use of chemical products, such as insecticides and other herbicides, to facilitate the catch of fish (Geo Haiti 2010). Fishery resources are therefore in a significant state of degradation and are not being replenished. Similarly, manatees, sea turtles, flamingos, sharks and dolphins, which are internationally protected, are threatened (Republique d'Haiti, 2004). Exportation of endangered species and their by-products, including coral, sea turtles, lobster, conch, and aquarium fish, is uncontrolled. Wargny (2004) states that species protected elsewhere, such as some shellfish, are openly captured in Haiti, even if "they are regarded as the least well-known in the Caribbean" (Geo Haiti 2010).

Uncontrolled hunting and predation by introduced species, such as cats, rats, dogs and mongoose are also taking a toll on native fauna, especially at biologically diverse wetlands such as at Lake Azeui, Trou Caiman, Bois Neuf Lake, and Lagon-aux-Boeufs (Birdlife 2010, Timyan 2008). Competition with introduced aquatic species, such as tilapia, is also likely to be affecting endemic species. Adding uncontrolled hunting and fishing to the effects of siltation, water diversion for irrigation, changed water regimes (flooding and subterranean flows rather than steady supply), eutrophication due to fertilizers, unregulated pesticide use, removal of woody riparian vegetation for fuelwood, is likely beyond the adaptive capabilities of much of the endemic flora and fauna (Timyan 2008) of the inland aquatic ecosystems.

As was mentioned in Section 2.1.1, most of the established protected areas are not generally supported by management plans and adequate resources. A serious problem confronting management of Haiti's National Parks is their occupation by farmers and the exploitation of bois gras - the resin soaked chips used to start charcoal fires - particularly in La Visite Park and the Forêt des Pins Reserve (Figure 4).

Figure 4. Trees used for bois gras production in La Visite Park. Photo credit: Scott Posner

Bois gras production involves shaving the bark and wood off the side of a pine tree during periods when the resinous sap is freely flowing. As the exposed wood becomes soaked with resin, chips are cut for sale in the markets. This process is repeated until the thin trees become susceptible to periodic winds and eventually snap. The dead trees are then removed and used for charcoal or other purposes.

Despite the existence of a community-based foundation, Fondation Seguin (www.fondationseguin.org), to promote conservation of La Visite's flora and fauna, no coordinated program of enforcement is in place. Park boundaries are poorly defined, and humans continue to live throughout the park, freely exploiting its natural resources and fragmenting the forests. Even at the source of drinking water for the entire plateau (Galet Sek), people are washing their clothes in the outflow, farmers are using chemical pesticides on vegetable plots next to the springs, and animals are grazing in the surrounding wetland, thereby compacting the soils and affecting infiltration and seasonal water flows (Figure 5). A crisis situation has resulted, one that can be resolved only through implementation of immediate and stringent measures to prevent further loss of broadleaf forests, and carefully controlled reforestation efforts (Rimmer 2005). Control of invasion by still more farmers is crucial, if the last vestiges of native ecosystems in Haiti are to be preserved relatively intact.


Figure 5. Occupation and uses at Galet Sek in La Visite Park. Photo credit: Scott Posner

In contrast, during bird surveys in Macaya National Park, scientists noted that, despite a damaging fire during the summer of 2005, the ridgeline forest of Pic Macaya was minimally disturbed by humans in February 2006; broadleaf forests on Pic Formon are moderately disturbed; while karst forest in the Morne Cavalier area continues to be seriously threatened by habitat loss and fragmentation. However, they observed little or no further forest loss since 2004 within a 0.5 km radius of their study site; some formerly cultivated areas were fallow and regenerating, while cows appeared to be absent (Rimmer et al. 2006).

Macaya National Park is in the Massif de la Hotte Key Biodiversity Area. With 99 percent of Haiti's original forest cover gone, amphibians (of which there are 18 Critically Endangered species within the Massif de la Hotte Key Biodiversity Area) are now confined to only a few key biodiversity areas, many of which are small islands of cloud forest habitat. Many amphibians can persist in very small patches of habitat—and the result is isolated areas with exceptional levels of endemism—and threat. Unfortunately, management capacity to protect Massif de la Hotte—like all key biodiversity areas in Haiti—is woefully inadequate.

Exotic animals prey on endangered species in the Pic Macaya and La Visite National Parks. Predators, such as feral cats, dogs and mongoose, hunt freely in designated park areas. Concern has been raised that this predation could jeopardize the endangered mammals Zagouti (Hispaniolan Hutia) and Nez Long (giant long nosed shrew), and the endangered bird, the Black-capped Petrel (Woods 1986, Woods and Ottenwalder 1986).

Haiti's mangrove forests, which are important for bank stabilization and protection of the coast against storm and wave action, and which are important to maintain the productivity of Haiti's estuary and nearshore waters are being filled to remove rubble from the earthquake or to provide space to construct buildings. Uncontrolled and unplanned rebuilding from the January 2010 earthquake also threatens biodiversity and tropical forests. Materials for building are being exploited in sensitive areas along streams and coastlines which contribute to sedimentation and negative impacts on coastal biodiversity. Uncontrolled dumping of raw sewage and rubble debris near coastlines, wetlands, and other water bodies contribute to water contamination and impacts on stream and marine biodiversity.

Emigration from Port-au-Prince to rural areas following the earthquake has also placed higher pressure on natural resources and exacerbates unsustainable exploitation of forests and fisheries. As displaced families resettle on lands previously used for crops, grazing or charcoal production, the need for food and fuel products shifts to other areas, again placing pressure on remnant forests, mangroves, and other areas of important biodiversity.

3. INSTITUTIONAL STRUCTURE, LEGISLATION, POLICIES AND ONGOING ACTIVITIES AFFECTING BIODIVERSITY AND FORESTS

In Haiti biodiversity issues are the responsibility and/or focus of a great number of government agencies and other actors ranging from academia to municipalities, non-governmental organizations (NGO's) and private firms and community based organizations.

3.1 Government of Haiti

The Ministère de l'Environnement (MDE): The Ministry of the Environment, created in 1995 after the Rio Summit, is responsible for the overall management and coordination of environmental activities. It prepares, implements and monitors national policy on the environment and is also responsible for monitoring compliance with obligations made under international Conventions such as United Nations Framework Convention on Climate Change (UNFCCC), Convention on Biological Diversity (CBD), Convention to Combat Desertification (CCD), Cartagena Protocol on Biosafety, Stockholm Convention on Persistent Organic Pollutants Convention (POPs), Basel Convention, and Montreal Protocol on Substances that Deplete the Ozone Layer. This Ministry has several sectoral divisions: *Soils and Ecosystems*

Division is responsible for land degradation problem management, protected area management, conservation and sustainable use of ecosystems and other biodiversity issues, abatement and control of coastal and marine degradation, protection of landscape, protection of water resources; *Life Quality and Sanitation Division* is in charge of land-based pollution control, sustainable pest and chemical uses and management, ozone depletion activities control, environmentally sound management plans for waste, management of hazardous products, land use regulation in relation to mitigation of ecological risks (climatic or geologic); *General Inspectorate for the Environment*: Law enforcement, Environmental Impact Assessment; *Environmental Education and Resources Promotion Division* has the primary focus of increasing awareness about the environment, preparing educational materials and promoting new behaviors and attitudes with regard to environmental problems, coordinating national networks of information on the environment, and issuing an annual report on the state of the environment; *Planning Division* is responsible for the overall planning in environmental matters, annual plan and public sector investment program, negotiation of cooperation projects, monitoring and evaluation of environmental programs and projects performances.Three important institutions recommended by the National Environmental Action Plan, dealing with biodiversity issues and subject to impact the current institutional panorama, are envisioned to be created in the light of the recent General Decree on Environment promulgated (Jan 06) by the Haitian Government. They are: The *Agence National des Aires Protégées* (ANAP) is an autonomous organization under the umbrella of the MDE, which will be in charge of managing the National System of Protected Areas; The *Fonds pour la Réhabilitation de l'Environnement Haitien* (FREH), financial mechanism to be fed by green taxes and public funds and devoted to support environmental programs and projects including biodiversity; The *Conservatoire du Littoral* to be in charge of natural and cultural patrimony related to coastline and marine areas;

The Ministère de l'Agriculture et des Ressources Naturelles et du Développement Rural (MARNDR): The Ministry of Agriculture, Natural Resources and Rural Development has several agencies that are responsible for major aspects of biodiversity. These agencies are the: *Fisheries Division* is involved in enforcement of fishery regulations, policy formulation on fishery, promotion of different kinds of aquaculture, inland fisheries; *Soils and Forest Division* deals with soils and forest resources management, watershed management and soil conservation; *Water Resources Division,* including the *National Meteorology Centre,* is responsible for irrigation strategies management and infrastructures, Early Warning System in relation to flooding and drought, water surface and ground water, and weather forecasting;

Agricultural Research and Documentation Centre (CRDA) : Phytogenetic and zoogenetic resources management, a component of biodiversity, lies within the CRDA; *Agriculture Division* including the *Quarantine Service and the Coordination Nationale pour la Sécurité Alimentaire (CNSA)* : responsible for crop protection (quarantine measures) and development, pesticide promotion, pest and disease control, trends analysis in food security, monitoring and guidance in food security policy.

Comite Interministériel de l'Aménagement du Territoire (CIAT): This committee was established by publication in Le Moniteur on 19 March 2009. The CIAT has four components—one of which is watershed management. It is expected that the CIAT will issue policy guidelines

related to watershed management. As of September 2009, however, the committee had not yet made any pronouncements in this regard. Because it is a very high-level committee—headed by the Prime Minister, it will necessarily move only slowly towards its objective. (DAI 2009).

The Ministère des Travaux Publics, Transports et Communications (MTPTC): The MTPTC has several agencies that have responsibility for, or are affected by, key aspects of biodiversity. These agencies include the: *Autorité Portuaire Nationale (APN)*: APN is dealing with regulation of shipping transportation and leads the management of UNCLOS (United Nation Convention Law of the Sea) and the MARPOL Convention for the country;*Electricité d'Etat d'Haiti Company and the Bureau des Mines et de l'Energie (BME)*: *Electricité d'Etat d'Haiti* and BME are involved in energy policy and strategies and regulation of sand mining. BME is particularly linked with the Ministry of Environment, through a Memorandum of Understanding, to implement some technical activities that come under the UNFCCC. BME has produced some educational brochures on climate change issues and has participated in assessments of alternative energy sources (http://www.bme.gouv.ht/insenpubcc/index.html);*Service National d'Eau Potable (SNEP) and the Centrale Métropolitaine d'Eau Potable (CAMEP)*: CAMEP and SNEP are the two leading Government agencies responsible for water supply. The third agency, the Poste Communautaire d'Hygiene et d'Eau Potable (POCHEP), is within the Ministère de la Santé Publique et de la Population (MSPP). CAMEP is responsible for water supply to Port-au-Prince and surrounding areas. SNEP is responsible for water supply to the smaller cities and rural areas, while POCHEP concentrates on rural areas with populations of less than 2,000. A great need exists for water wells, as most of the rural population uses surface water which is often contaminated. Water supplies are also becoming limited and undependable, in part due to the effects of deforestation on the watersheds. Both SNEP and POCHEP work in this sector along with NGO's, various humanitarian relief organizations, as well as the Ministère de l'Agriculture des Ressources Naturelles et du Developpement Rural (MARNDR). **The Ministère de la Planification et de la Coopération Externe (MPCE) :** The MPCE's mandate includes preparing land-use policy and spatial management strategies, zoning the territory, mapping the density of housing for the entire territory, establishing spatial data bases through its GIS Centre (Centre National de l'Information Géo-Spatiale - CNIGS), and formulating and implementing national and regional development plans. CNIGS will play a critical role in protected area management, by delimiting the boundaries of the areas to be protected. Currently, the legislation only states the amount of area to be protected, but the actual boundaries are not mapped.

The Ministère de l'Intérieur et des Collectivités Territoriales (MICT): The MICT, through its Civil Protection Directorate, which has permanent divisions for the management of risks and disasters, provides leadership for hazard and disaster management. MICT and MDE worked together to lead a working group to develop the Post-Disaster Needs Assessment following the earthquake disaster on January 12, 2010. MICT also intervenes in watershed management.

The Ministère de la Santé Publique et de la Population (MSPP): Aspects dealing with water quality control and other environmental health-related problems (water diseases, atmosphere pollution diseases), and population policy are within this Ministry's jurisdiction. The MSPP has also a lead role for the implementation of norms suggested by the Codex Alimentarius dealing with labelling and hygienic aspects of products and their composition.

The Ministère du Commerce et de l'Industrie and Ministère du Tourisme are involved in coastal development and promotion of tourism. At the national level this Ministry is implementing World Trade Organization agreements dealing with environment such as the Agreement on Sanitation and Phytosanitation measures.

Ministère de la Culture et de la Communication (MCC): MCC promotes through the National Institute for Historic Preservation – ISPAN - the protection of the natural and historic heritage of Haiti including coastal and marine sites.

The Ministère de la Justice et de la Sécurité Publique (MJSP): The mandate basically includes the enforcement of the Law with regard to environmental violations. MJSP is working with the Ministry of Environment to establish an Environmental Surveillance Force to save the remaining forests from destruction, prevent encroachment in protected areas and improve urban environment.**The Ministère de l'Education Nationale et de la Formation Professionnelle (MENFP):** involved in the development of curricula related to environment.

The Ministère de l'Economie et des Finances (MEF): Fiscal policy, tax collectorship, and budget repartition. The Fonds d'Assistance Economique et Sociale (FAES) under the Ministry of Finances and Economy was primarily established to support economic and social projects in the context of an anti-poverty strategy designed by the Haitian State. Currently FAES is providing or leveraging funding for Community Based Organization and Municipal projects that have an environmental restoration component.

As can be seen above, a great many ministries and agencies play a role in the management and protection of biodiversity and tropical forests in Haiti. Unfortunately, their effectiveness is hindered by overlapping roles among agencies, government instability, insufficient funding, equipment and training. The Ministry of the Environment has no organic law which becomes an obstacle in the performing of its duties (Geo Haiti 2010). The Framework Decree on Environmental Management of 2006 (see page 36 below), far from being an organic law, does however establish the responsibilities of this Ministry in relation to the other stakeholders in the sector.

Existing struggles in the management of the environment of Haiti have recently been compounded by the loss of people, infrastructure, data and funds during the January 2010 earthquake, followed by the political unrest and uncertainty following the November 2010 elections. It is clear there is a need for capacity building, education/training, and new law reform to strengthen the ability of the Haitian people to manage and protect their unique and globally important biodiversity and tropical forests.

3.2 Laws and Policies

3.2.1 Legislation affecting biodiversity and forests

Haiti's current environmental legislation provides a basic framework for the conservation and sustainable use of biodiversity. More than 100 laws and decrees, to indicate the most important of them, characterize this juridical body, as well as some fifty Multilateral Environmental Treaties signed or ratified by Haiti (See USAID 2006 Appendix 9 for international agreements to which Haiti is a Party). However the word *environment* only appears in the national juridical vocabulary after the Rio Summit in 1992 and the word *biodiversity* only since 2006.Eighty percent (80%) of the environmental legislation is composed of pieces and laws and decrees dealing with trees, forests, soils and fisheries. The majority of the laws are not really enforced given the weakness of State Agencies. These laws are primarily composed of different prohibitions and do not promote stakeholder participation. Historically, the starting point was legal restrictions enacted to protect forests and certain species of fauna and flora. Special authorizations could be delivered to allow cutting trees in a forest or for fishing during specific seasons. For example, in

the Fisheries Laws of November 27, 1978, it is forbidden (art 97): a) to capture, to sell, to export the *triton* (*Claromis variegata*) b) to capture the green and the Caray turtle during the nesting season between May and October c) to capture sea turtles and caray on the beach d) to collect sea crabs between December 11th and March 31st. It is also forbidden (art 112) a) to capture, sell or buy small conch shells and to engage in the commerce of their shells, and b) to export lobster and conch without adequate cleaning. The Constitutional Law of 1987 contains provisions that set forth governmental duties to protect the environment and the state's natural resources. This Constitution states that the State should organize the valorization of natural sites and ensure their protection (art 254). To protect forestry reserves and expand forest cover, the state is required to promote the development of clean energy: solar, wind and others (art 255). In the framework of environmental protection, obligations are placed on the State to create and care for botanical and zoological gardens in some points of the territory (art 256). Law specifies requirements for flora and fauna protection and sanctions people who break the law (art 257). The General Decree on Environment, *Décret Cadre sur l'Environnement*, prepared by the Ministry of Environment with the assistance of the Inter-American Development Bank (IDB). This Decree was approved by the Interim Government (November 2005) and promulgated to the Official Journal of the Haitian State, *Le Moniteur,* on January 26, 2006 (161st Year, Number 11). The approval of this Decree represents, in theory, a major step in terms of prospects to solve jurisdictional conflicts in environmental management in the country. The decree represents the legal foundation of the national environmental policy and provides guidance for responsible behaviour of Haitian citizens in terms of sustainable development. It is a legal umbrella strategy for all sectors of the environment in Haiti, including biodiversity. The General Decree on Environment contains a specific chapter dealing with **Biological Diversity** (art 135 – 139). Article 136 stipulates: Authorities in the country should ensure in situ and ex situ biological diversity conservation. **Other related biodiversity issues** in this General Decree have to deal with **Environmental Planning** (Chapter 2, art 29.4, 29.5), **Land Use Planning** (Chapter 3, Section related to Common regulations: art 33.b, art 34; Section 4 regarding protection of the natural and cultural heritage: art 43-art 47), **Protected Areas** (Chapter 3: in fact it should be Chapter 4: art 48 – art 55), **Environmental Evaluation** (art 56 – art 61), **Environmental Surveillance** (Chapter 5: art 62 - art 67), **Environmental Education** (Chapter 6: art 74 – art 76), **Environmental Funds** (Chapter 7: art 77 – art 79), **Technical and Scientific Research** (Chapter 9: art 87 – art 88), **Common Norms** (Title 4 and Chapter 1: art 89-art 93), **Soils and Terrestrial Ecosystems** (Title 4 and Chapter 2: art 94 – art 105), **Fossils and Mineral Resources** (Title 4 and Chapter 3: art 106), **Continental Waters** (Title 4 and Chapter 4 art 110, 111, 112,115, 116, 117.6, 121), **Marine Waters and Associated Resources** (Title 4 and Chapter Title 4 and Chapter 5 art 126 – art 132).

The decree calls for an institutional and consensus-based framework to be established in terms of environmental management, the National Environmental Management System (Système National de Gestion de l'Environnement, NEMS). The foundation of the NEMS is the fact that environmental management proceeds from collective responsibility and must be shared between the different sectoral ministries, and between the Government and civil society. The NEMS has struggled to become established, particularly because the MDE has not systematically received the support of its partners enabling it to properly fulfil its central role of

coordination of the various partners, i.e. the sectoral ministries1, local intermediaries and civil society. Thus, operations conducted by the MDE have been confined principally to the implementation of externally funded projects, such as the management of protected areas, local development and the production and monitoring of basic environmental information via the National Observatory for the Environment and Vulnerability (ONEV) in particular, while environmental assessment and appraisal of the consequences on the environment of sectoral policies, plans and programs, at the heart of the MDE's mandate as set forth in the decree, were not addressed by the MDE due to a lack of resources.

During the earthquake of January 2010, the NEMS' partners sustained significant damage and loss. A rapid analysis of the immediate effect of the earthquake on the NEMS' key stakeholders reveals the following: (i) extensive destruction of buildings and equipment belonging to the MDE and several of its partners, (ii) substantial loss of technical capabilities and institutional memory, in some cases up to and including the virtually total disappearance of an institution (e.g. the National Centre for Geo-Spatial Information (CNIGS), (iii) the inability to operate or react in terms of immediate involvement, analysing circumstances calling for its attention and intervening in a way commensurate with its central position in the NEMS (GOH 2010).

As a party to the Convention on Biological Diversity, Haiti must implement specific obligations under the Convention. The Convention, in part, places obligations on State Parties to: a) put in place measures to develop or maintain the necessary legislative and or regulatory provisions for the protection of threatened species and populations b) take legislative, administrative or policy measures to facilitate access to genetic resources by national legislation c) as far as possible introduce appropriate procedures requiring environmental impact assessments of proposed projects which may have a significant adverse effect on biodiversity and where appropriate allow public participation d) subject to national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity d) take such legislative, administrative or policy measures to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology, and provide for the effective participation in the biotechnological research, and fair and equitable sharing of benefits arising from the commercial utilisation of genetic resources, especially by countries providing genetic resources.Several efforts at clarifying and widely distributing environmental laws have been undertaken:

1. The codification of Haitian Environmental laws realized by COHPEDA, a local NGO;
2. An Index of Haitian laws from 1804 to 2000 prepared by the Ministry of Justice with the assistance of UNDP. The overall set of environmental legislation including International Conventions on Environment (ICE) ratified by Haiti is part of this Index. This will facilitate distribution and use of Haitian environmental laws among judges and lawyers;
3. A Guide for the monitoring of ICE including UNCCD, CBD and UNFCCC;

[1]Ministry of the Interior and Territorial Communities, Ministry of Agriculture, Natural Resources and Rural Development, Ministry of Public Works, Transport and Communication, Ministry of Planning and External Cooperation, plus the Ministry of Culture and Communication and the Ministry of Tourism

Still, more regulatory improvements are needed to allow effective manage and protection of the biodiversity and tropical forests of Haïti. Following the clarification of the environmental laws, additional efforts must be made to publicly distribute those laws, educate the public, and effectively implement the regulations.

Enforcement of laws at protected areas is currently lacking. An alarming number of local residents near protected areas do not comply with environmental regulations or recognize the authority of protection officers. An extreme of this was found at La Visite National Park, where the team learned that the Surveillance Corps assigned to patrol the area was not accepted by the local community, officers were threatened, at least one was attacked and injured, and the Corps left the area, leaving no personnel in place to monitor or regulate activities and resource exploitation in the park. Enhanced governance and rule of law related to biodiversity and tropical forests are critical needs.

3.2.2 Policies affecting biodiversity and forests

In December 1999 the Haitian government, with the endorsement of the Council of Ministers, published the National Environmental Action Plan (NEAP) with the support of UNDP, USAID, CIDA, and the World Bank. The NEAP is the major policy that offers guidance on all aspects of environmental management. The specific objectives are to:

- Strengthen and rationalize the management of the National System of Protected Areas;
- restore the ecological balance of the watersheds through the implementation of exploitation norms and best practices;
- improve the quality of life through better management of urban and rural areas as well as the valorization and conservation of natural and cultural heritage; and
- provide a framework for better coherence among plans and programs within the sector.

The NEAP process and its outputs enable Haiti to identify a strategy which sets policy direction and defines an action plan aiming to reverse the drastic environmental degradation observed in the country. The core elements of the strategy and the action plan are used as a research platform, or logical framework, to design specific and individual projects aimed at addressing the key issues of: energy for sustainable development, environmental education, conservation and sustainable use of biological diversity, integrated watershed and coastal management, management of natural disasters and hazards, and management of urban waste disposal. The National Risk and Disaster Plan (NRDP), supported by UNDP, was produced in 2000 in light of the great vulnerability of Haiti to natural disasters. The NRPD has two main objectives: 1) work on causes and factors that originate risks in order to reduce the impact of disasters 2) strengthen the capacity response in case of disaster at the national, departmental and communal level. After the earthquake of 12 January 2010, a Post-Disaster Needs Assessment (PDNA) was developed by a team of specialists from the Ministries of the Environment (MDE),

of the Interior and Territorial Communities (MICT) and of Planning and External Cooperation, the Ministry of Justice and Public Security and the Ministry of Public Works, Transport and Communication of the Government of Haiti, environmental groups and experts from the international community of agencies from the United Nations (UNDP, UNEP), the World Bank, the European Commission and the ECLAC. The Working Group assessed damage on the basis of four thematic areas relating to the environment and natural resources: environmental governance, land and resource management, pollution and nuisances and disaster risk management. The PDNA proposes a framework of actions which, in terms of Environment and Disaster Risk Management, may form a structure for re-establishing, restoring, reconstructing and developing the nation on a sustainable basis.

The Haitian government, under its commitment to fulfil its obligations to implement UNCCD, has approached the Global Mechanism, one of the financial mechanisms of the UNCCD, to assist it in taking a global view of the desertification process in the country and derive comprehensive actions to tackle the issue. A comprehensive Desertification National Action Program Process in the border region with Dominican Republic (PAN-FRO), with the technical support of GM and the FAO and financial assistance from CIDA is underway. The PAN-FRO is an entry point to prepare the overall National Action Plan to Combat Desertification (NAP-CD) in the country.

The sectoral Watershed policy of the MARNDR, published in 2001, provides orientation and guidelines to better manage soils in the watersheds and outlines the importance of stakeholder participation in all aspects of decision-making dealing with watershed management.A Draft of an Integrated Watersheds and Coastal Areas Management policy (IWCAM), supported by UNEP, was developed in 2001. The general objectives of this Plan are set forth by socio-economic and ecological conditions that influence the well-being of Haitian population namely: high rate of poverty, crisis in the local economy, and accelerated degradation of watersheds and coastal environments. The IWCAM proposes actions intended to provide a coherent set of specific and concrete actions for operational activities conducive to the improvement of integrated management of watersheds and coastal areas in Haiti. In response to changes in watersheds and coastal ecosystems in the country, the Plan put the emphasis on four interlinked strategic areas. The two areas of importance to this study are: 1) The restoration of critical coastal ecosystems and associated watersheds in order to maximize the sustainable benefits to local communities from using resources within watersheds and coastal zones to generate food, employment and income, supply safe water and conserving biodiversity for the benefit of local and global community; and 2) The reduction of communities' vulnerability to natural disasters - the focus is to prepare communities for and respond to natural and human-induced disasters. Haiti is party to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, commonly called the "London Convention" or "LC '72. The main objective of the London Convention is to prevent indiscriminate disposal at sea of wastes that could be liable for creating hazards to human health; harming living resources and marine life; damaging amenities; or interfering with other legitimate uses of the sea. The 1972 Convention extends its scope over "all marine waters other than the internal waters" of the States and prohibits the dumping of certain hazardous materials. It further requires a prior special permit for the dumping of a number of other identified materials and a prior general permit for other wastes or matter. This is important to note as the earthquake rehabilitation actions have plans for

shoreline fill and creation of artificial reefs using rubble, which could impact coastal resource biodiversity.

3.3 Bilateral and Multilateral Organizations Associated with Biodiversity

A large number of donors have been and continue to be interested in assisting Haiti in the field of environmental protection and enhancement. After the earthquake of January 2010, some donors shifted their focus to disaster recovery, while others began to look at the conditions which resulted in the earthquake and hurricanes of 2008 taking such a huge toll on Haitians and their environment.

Inter-American Development Bank (IDB): The IDB often provides loans, small grants and technical assistance in Latin America and Caribbean countries. The IDB is Haiti's largest multilateral donor, currently focusing on priority areas that have been identified with country authorities: transportation and infrastructure, productive activities and private sector development, basic services, prevention and mitigation of natural disaster risk and environmental sustainability, and economic governance.

A $30 million IDB grant to MARNDR will help limit flooding and erosion in watersheds. Planned public anti-flooding works in three critical watersheds (Grande Rivière du Nord, Ravine du Sud and Cavaillon watersheds) will cover 6% of the Haitian territory. The project seeks to limit torrential flows and protect infrastructure and property exposed to flooding or landslides. The project will also offer direct support for sustainable agriculture in the watersheds.

A $5 million IDB loan has been approved to finance institutional strengthening and start-up activities aimed at establishing a functional environmental governance structure. It would consist of three components as follows: (i) support to the national system of environmental management, including professional training in critical areas for the Interim Cooperation Framework, structuring the National Environment Council and other coordination mechanisms; (ii) capacity building for local environmental management, including implementation of pilot projects in resource management and restoration; (iii) strengthening of the national environment

information system including the design of applications for future priority setting for management and restoration. A parallel $3 million GEF grant has also been approved.

A $200,000 IDB grant will finance technical assistance to the MARNDR Fisheries Division in order to enhance the national plan for fisheries development.

Global Environment Facility (GEF): The GEF unites 182 member governments — in partnership with international institutions, nongovernmental organizations, and the private sector — to provide grants to developing countries to address global environmental issues.

The IDB grant aimed at reducing flooding in the Grande Rivière du Nord, Ravine du Sud and Cavaillon watersheds is complemented by a $3.44 million IDB/GEF grant (over four years) to the Ministry of Environment that will support reforestation in key watersheds in the southwestern part of the country, strengthen national watershed administration capacity based on a sustainable land and forest management approach, improve the management and restore 200 hectares of Macaya Park, build local capacity to protect soil and sequester carbon while favoring fruit and timber tree plantations and greater livestock productivity in the upper parts of the watersheds, solve land tenure conflicts, build small dams and water tanks, promote sheep breeding, and co-finance a coffee-washing center, as well as implementation of a carbon stock and sequestration monitoring system to help prevent greenhouse gas emissions in the area.

GEF is also funding projects related to climate change, such as providing solar power to Port-au-Prince ($1 million), building national and local adaptive capacities, enhancing the resilience of current coastal development policies and plans to climate change risks, as well as implementing a set of pilot adaptation measures in response to the most pressing threats posed by climate change on coastal populations and economy ($3.5 million).

The GEF/UNDP small grants program funds community groups for sustainable development projects with a link to biodiversity, desertification, climate change, persistent organic pollutants, or international waters. Grants are limited to $50,000 but the total can be much more with co-funding. Examples of projects funded in the Northeast include grants for apiculture, product transformation by women directed groups, and tree planting.

UNEP: Currently, the focus of the United Nations Environmental Program in Haiti is on assisting in planning and coordination to work towards a clean energy program that is set out in one government owned master strategy and detailed in multiple sectoral plans/strategies and proposals. This program is expected to include a first work plan of to 2-3 years, have financing needs in the order of US$20 - 40 million and will seek multiple funding sources and implementation partners for specific projects.

In close collaboration with a number of partners and UN agencies, UNEP supports the Haiti Regeneration Initiative (HRI), a large-scale nationally led integrated joint program (www.haitiregeneration.org). This five to twenty-year program, with an estimated budget of over USD 1 billion, aims to reduce poverty and vulnerability to disasters through the restoration of ecosystems and livelihoods based on the sustainable management of natural resources.

The Haiti Regeneration Initiative (HRI) comprises the following major components:

- The Network and Technical Assistance Facility (TAF) aimed to provide free technical expertise on environmental issues to national and international institutions. Within the context of post-disaster Haiti, the Technical Assistance Facility, already in place before the earthquake, will be re-prioritized to focus on the relief and early recovery needs, associated environmental and energy issues and the geographic regions that are of most concern. The UNEP-led Technical Assistance Facility, which will be expanded, will provide a pool of expertise in areas such as disaster risk reduction, agriculture, waste, energy, forestry/agroforestry, hydrology, erosion control and climate change.
- Geographic and thematic projects, including marine and coastal restoration, integrated program for micro-catchments, energy, governance etc.
- The Campaign aiming to raise awareness at the national and international level on environmental issues and to facilitate fundraising.

UNDP: The United Nations Development Program is active in Haiti on a variety of development projects, most of which have a component promoting sustainability and environmental improvement. For example, UNDP is working with the Ministry of Environment on the AECID funded Pedernales project (2007-2011) in the Southeast Department. The objective of the project is to manage watersheds at Belle Anse, Jacmel and Anse à Pitre protect and conserve the natural resources of the watersheds in synergy with sustainable development micro-projects, such as a compost center, and support programs for commercial fruit and castor bean production.

Two high priority UNDP funded projects that will contribute substantially to the protection and enhancement of biodiversity and tropical forests are the Programme d'appui à la Gestion de l'Environnement (PAGE) and Système National d'Aires Protégées (SNAP). PAGE is being funded to strengthen institutional capacities in the environmental sector through reinforcing environmental management capacities, integrating the management of the environment and natural resources into development policies, establishing the Observatoire National de l'Environnement et de la Vulnérabilité (ONEV).

EU: The European Union is funding ($4 million through 2011) the Caribbean Biological Corridor project being implemented by MDE and UNEP, along with IUCN and partners in the Dominican Republic and Cuba. An office has been established and staffed in the Dominican Republic and efforts are underway which will initially focus on mapping out the network of terrestrial and marine protected areas that would form the Corridor, creating sustainable livelihoods and building capacity for implementation by participating countries.

The EU is also funding the Cross-border Environmental Project (Projet Environnemental Transfrontalier – PET) which focuses on management of natural resources and watersheds surrounding Lac Azuei (Haiti) and Lac Enriquillo (Dominican Republic). Water levels in both lakes have been rising since 2004, resulting in flooding and environmental deterioration along the border. Environmental, agricultural and economic impacts have been noticeable, particularly in the border area of Malpasse where a bi-national road joins the two countries; 11 communities

along Lake Enriquillo have also suffered repercussions. The transnational road has been seriously damaged by overflowing water, particularly on the Haitian side as well as at the border, causing floods and the destruction of habitats. This has resulted in a critical loss of biodiversity, crops and arable land in many neighboring provinces. Sustainable development and protection of natural resources are linked in this project. The objectives are to:

- pursue research efforts focusing on the watersheds supplying the lakes;
- to implement a wide-ranging plan for bi-national reforestation including native and endemic species in these watersheds so as to facilitate effective infiltration of rainwater;
- to diminish the rate of runoff and slow down the process of erosion;
- to carry out development projects in regard to agricultural development, fisheries and ecotourism, with the aim of generating new sources of income for lakeside communities;
- and to strengthen and build upon bi-national coordination with regard to issues pertaining to the lakes and harnessing knowledge and expertise through South-South cooperation.

AECID: Haiti has been a high priority for the Agencia Española de Cooperación Internacional para el Desarrollo (Spanish Agency for International Development Cooperation) since 2005. Compared to other donors in Haiti, Spain ranks ninth (the 5th bilateral) with annual contributions of approximately $22 million in 2007 and 2008. The Araucaria XXI-Haiti Phase III project has been the leading AECID project in terms of biodiversity with a projected duration of 2007-2011. The objective of the Araucaria project is to work with MDE to form a sustainable development strategy for the Southeast Department that covers institution building, a management plan for La Visite National Park, Agroforestry and reforestation at Belle Anse, solid waste management at Cayes-Jacmel-Marigot, environmental education, and enhancing food security and self sufficiency in the communities of Bell Anse and Grand Gosier through organic food production.

The Pedernales project is funded by AECID and implemented by UNDP and MDE to develop measures to conserve and protect natural resources through watershed management and sustainable development in the Southeast watersheds of Belle Anse, Jacmel and Anse a Pitre. Enhancing production, establishing a compost center, and fruit marketing are some of the pilot micro-projects being implemented through Pedernales.

AECID (along with the German Red Cross) has been funding the MARNDR to enhance and conserve the marine fishery and the quality of life of the people dependent on that resource in the Southeast Department. That project began in 2007 and is scheduled for completion in 2010.

CIDA: The Canadian International Development Agency funds projects, often implemented through Oxfam Quebec, related to poverty reduction, socio-economic development, environmental rehabilitation, Agroforestry, sustainable use of natural resources, and watershed management. They are particularly active in, and are the primary funding agency for, the bi-national project to rehabilitate the Artibonite watershed, which crosses into the Dominican Republic.

CEPF: The Critical Ecosystem Partnership Fund is a joint initiative of l'Agence Française de Développement, Conservation International, the Global Environment Facility, the Government of Japan, the John D. and Catherine T. MacArthur Foundation, and the World Bank. CEPF provides grants for nongovernmental and other private organizations to help protect biodiversity hotspots (CEPF 2010). The Ecosystem Profile for the Caribbean Islands Biodiversity Hotspot identifies 17 Key Biodiversity Areas in Haiti, seven of which are considered wholly irreplaceable on a global scale because they contain the only known populations of a globally threatened species.

3.4 Non-Governmental Organizations

Literally hundreds of non-governmental organizations are active in Haiti, many of which include some aspect of environmental protection or sustainable development in their goals. A brief description of some of the most active organizations working toward the preservation and restoration of biodiversity and native forests follows.

Fondation Sequin: Fondation Seguin is active in La Visite National Park, with projects that focus on environmental education, working with aid from Taiwan to plant non-native bamboo in the buffer zone, and working with aid from the German government toward prevention of hydrological catastrophes on or below the Seguin Plateau. The third objective is accomplished through soil conservation structures in ravines and gullies, reforestation with native species, promoting eco-friendly alternatives to cutting and farming in the forest, and payments for ecosystem services. Fondation Seguin has a DED (German Development Service) grant and technical experts on site to support activities in local infrastructure, eco-friendly micro-enterprise development and a participatory zoning initiative. Zonation divides the land in the area of La Visite National Park into 5 categories ranging from natural forests to settlement areas. DED grants are used to fund payments for ecosystem services to landholders to adopt the zoning and range from 250-875 USD according to type of zone and activities appropriate to each zone. The initial agreements are with landowners agreeing to protect plots of hardwood forest and are $50/ha/year. Fondation Seguin also indirectly assists the administration of La Visite National Park through small-scale plantings of the endemic pine (*Pinus occidentalis*), tourist management with the operation of a small hotel and local employment of park volunteers (Timyan 2009). The USAID WINNER project has assisted Fondation Seguin by constructing a wire mesh fence to keep grazing animals out of the bamboo plantations.

Societé Audubon Haiti (SAH): is active in Macaya National Park where they are implementing a multi-year community development project that integrates conservation objectives with simple strategies to improve the livelihoods of buffer zone residents. Innovative contracts, adapted along the lines of conservation easements and community-based environmental education, are

a promising kind of payment for ecosystem services that SAH has developed. SAH receives funding through the Jensen Foundation and ACDI in partnership with Birdlife International.

SAH is active in La Visite National Park on an occasional basis, primarily by assisting in scientific studies relating to the flora and fauna. Several US-based scientific institutions (Cornell Lab of Ornithology, Vermont Center for Ecostudies, Penn State University, and University of Puerto Rico) have on-going scientific studies and are actively interested in the conservation biology of La Visite National Park. These institutions typically coordinate their activities with SAH members, as do several international groups such as Conservation International, The Nature Conservancy, Birdlife International, Critical Ecosystems Partnership Fund, Grupo Xaragua and Fundación Moscoso Puello. SAH has partnered with REPIE (Réseau d'Enseignement Professionel et d'Interventions Écologiques) in the area of environmental education and related interventions among local community groups (Timyan 2009).

Helvetas: The Swiss government's Direction pour le Développement et la Coopération (DDC) funds helvetas Haiti, which is mostly active in the Mare Rouge area east of La Visite National Park. They focus on cash crop and income generating activities as well as collaborative efforts with MARNDR to reforest sections of Unit 2 of the Forêt des Pins. Helvetas is also collaborating with Fondation Sequin to implement a zoning plan that aims to protect and restore important natural areas while increasing productivity of land devoted to agriculture (Timyan 2009).

Birdlife International: In addition to working with Societé Audubon Haiti, Birdlife International has described ten Important Bird Areas in Haiti and is involved with partners to conduct bird surveys in important areas for biodiversity. Important Bird Areas in Haiti are: Aux Becs-Croises, Aux Cornichons, Aux Diablotins, Bois Musicien, Coquillage-Point Est, Lac Azuei, Lagon-aux-Boeufs, Les Grottes, Les Todiers (dba Citadelle-Sans Souci-Ramier), and Trou Caiman (www.birdlife.org).

The Nature Conservancy: The Ministry of Environment has signed a Memorandum of Understanding (MOU) with The Nature Conservancy (TNC) to complete the National System of Protected Areas of the Country. The finalization of the NBSAP is included among the areas of action prioritized by the MOU (GEFonline 2010).

Trees for the Future (http://www.plant-trees.org/projects/haiti.htm#update): has been working in Haiti since early 2002 supporting projects throughout the country. They work with local farmers and farming groups, planting trees to reforest degraded hillsides, produce sustainable charcoal and fuel wood, produce biodiesel, and establish intensive hillside farming practices. They have started a major program to reforest large portions of the Arcadine coast, particularly in the degraded mountains in between Cabaret and St. Marc. One million trees were planted along the Arcadine coast in 2009 and 500,000 more were expected to be planted by the end of 2010. They are also supporting numerous projects throughout the country. Initially, local people are planting multi-purpose fast growing trees such as *Leucaeana leucocephala*, *Swietenia macrophylla, Jatropha curcas*, and *Moringa oleifera*, which will grow on the degraded lands. A Trees for the Future training and resource center has been opened in Arcahaie.

Fairchild Tropical Botanic Garden in Miami (http://www.bgci.org/resources/news/0069/): has a young seed orchard growing the rare and endemic *Attalea crassispatha* which is found only in Haïti. Since only a handful of adults remain in Haïti and the native habitat is severely degraded, botanic gardens are the only hope for its survival. It is hoped that this ex situ conservation of the species will provide seed for conservation work. They represent in one planting almost as many plants as are left in Haïti.

4. ANALYSIS OF POTENTIAL IMPACTS TO BIODIVERSITY AND FOREST RESOURCES DUE TO CLIMATE CHANGE AND NATURAL DISASTERS

The biodiversity and forests of Hispaniola have been shaped by the climate and geological forces, giving rise to the unique ecosystems of the island. Therefore natural disasters themselves are not a threat, but are a natural component of the ecosystem. However, the effects of natural disasters are magnified when they occur in ecosystems that are already vulnerable due to factors such as pollution, land clearing, over-harvesting, and climate change (WGIII 2008).

The rate of climate change in the Caribbean is already following the pattern observed globally and elsewhere in the Northern Hemisphere (CEPF 2010). Temperatures and the frequency of extreme weather events, such as hurricanes and droughts, have already increased in the region, and there is particular concern over predicted sea level rise. An assessment of environmental vulnerability in Haiti (Smucker et al. 2007) noted that the country has been afflicted by a significant increase in severe natural disasters. Since that time, Haiti has experienced four tropical storms and hurricanes in 2008 and a devastating earthquake in 2010. Although earthquakes, such as Haiti experienced January 12, 2010 are not affected by climate change, the subsequent movement of people into ecosystems already overwhelmed by human impacts, hurricanes and climatic stresses compounds the threats and impacts to the biodiversity of Haiti. Given current trends and future forecasts, those threats are expected to continue.

4.1 Potential Impacts of Climate Change to Biodiversity and Forests

The biodiversity and forests of Haiti are directly linked to its climate. As the global climate changes, the ecosystems of Haiti are expected to be impacted by increasing air and seawater temperature, changes in rainfall patterns and quantities, and rising sea-levels. Rainfall is anticipated to decrease throughout the Caribbean, particularly in the summer wet season (CEPF 2010). Hurricanes are predicted to become more severe with increased precipitation and higher peak wind speeds. Projections of sea-level rise in the Caribbean range from 0.18 to 0.59 m to 0.5 to 1.4 m by the end of the 21st century.

As rainfall patterns change to produce less frequent, but more severe storms, the fragile soil conditions brought on by unsustainable hillside agricultural practices are likely to be exacerbated by heavy runoff and erosion. Eroded lands and mudslides are accompanied by shifts of human pressure from areas of lost productivity to any remaining uncultivated areas,

threatening the ecosystems in place. Reduced infiltration resulting from deforestation, soil compaction and loss of moisture holding organic matter is resulting in greater runoff. The increase in periodic heavy rain events and decreased infiltration are projected to result in more frequent and severe flooding events in the lower reaches of the watersheds.

Coastal ecosystems are already being affected by sediment coming from eroded hillsides. Increased erosion resulting from climate change combined with increased water temperatures and sea level may have drastic impacts on the marine resources of Haiti. The recorded rise in sea level and sea surface temperatures are primary causes for increased beach erosion, salinization of fresh water aquifers and estuaries, and increased coral reef bleaching throughout the Caribbean (Smucker et al. 2007). Coastal estuaries, lagoons, mangroves and other near-shore habitats, are likely to be highly impacted by sea level rise, and as a result are expected to lose productivity and suffer species loss (CEPF 2010). Increased hurricane intensity will only add to the problem, as greater storm surges and severe flooding will further erode coastal shorelines and habitats.

The few remaining forest ecosystems of Haiti (Macaya National Park, La Visite National Park, and Forêt des Pins) are montane ecosystems, which are particularly susceptible to climate change. As temperatures increase, forests are expected to gradually shift upward in altitude. Unfortunately, the remaining forests of Haiti are already in the highest, most inaccessible areas with no potential for an upward shift. Although the ecosystems of Haiti are adapted to hurricanes and other severe weather events, the open canopy and weakened trees (due to cutting for resin wood) leaves the pine forests of the La Selle mountain range particularly susceptible to wind throw during severe weather events. Climate change resulting in increased severity of hurricanes and other storms may impact large areas of this diminishing forest cover.

The potential severity of the impacts of climate change shows a need for increased resiliency and redundancy in the ecosystems of Haiti. Slowing the degradation of the remaining biodiversity hotspots will increase the resiliency of those areas to withstand the pending changes. Increasing the number of intact natural areas would provide the redundancy needed in the event some areas or sub-populations of rare species were eliminated by extreme weather or other natural disasters.

4.2 Impacts of Hurricanes and Extreme Weather Events

The Caribbean is one of the most hurricane prone regions of the world and Haiti is the country with the highest level of vulnerability to hurricanes (GEO Haiti 2010). Heavy rainfall accompanies hurricanes and tropical storms, and may, especially in places where forest cover has been destroyed or degraded, cause landslips on steep hillsides and result in flooding and further damage (CEPF 2010). For example, between 1.5 million and 1.8 million cubic meters of silt were deposited in Gonaives, following the 2008 storms (GEO Haiti 2010), which resulted in the loss of habitat for aquatic species due to sedimentation; and reduced water quality (around 4,700 water wells were rendered unsafe in this city in 2008).

Haiti is considered especially susceptible to impacts from hurricanes because it lies on the primary pathway of tropical storms that originate in the Atlantic and strike Caribbean islands every hurricane season, and because it has low resilience due to the huge loss of forests and

high degree of environmental degradation (Smucker et al. 2007). Adaptation to extreme weather events is a slow process in intact ecosystems and the increased frequency of such events on species and ecosystems already stressed by fragmentation and degradation may be more than some small populations or fragments can withstand.

As hurricanes become more frequent and severe in Haiti, there is a chance that in addition to the effects on fragile ecosystems, restoration projects themselves may be affected by the storms. Well planned project site selection can reduce that risk and enhance the longevity of the results of successful projects. For example, treating the upper reaches of watersheds may be necessary before restoring the floodplains, where unmitigated flooding can minimize the potential for project success.

In the last 20 years coastal development has begun to affect mangroves greatly and they are receiving increasing pressure for production of charcoal and building poles. The exploitation of mangroves and the destruction of coral reefs now expose coastal areas to storms and hurricanes (GEO Haiti 2010).

4.3 Impacts of the January 2010 Earthquake on Biodiversity and Forests

Haiti is located within a seismically-active zone. Four fault lines run through its territory and these can produce strong earthquakes. The recurrence period is estimated to be 150-200 years for the two largest cities, Port-au-Prince and Cap Haïtien, both located directly on these fault lines (GEO Haiti 2010). The January 2010 earthquake has thrown more than 2 million people into a precarious existence, resulting in significant population displacement towards the interior of the country and causing an increased demand on energy and firewood resources, including housing and food in these regions. The illegal clearing of land in and around the affected cities, as well as in the rural areas affected by the movement of populations, could result in increased pressure on forestry resources and may raise the levels of land degradation as a result of the higher levels of erosion (GEO Haiti 2010).

The 2010 earthquake, the government action plan for recovery and development (PARDN) the Interim Commission for Recovery of Haiti (ICRH) and the Haiti Recovery Fund (HRF) have changed the development paradigm in Haiti for at least 5 years and possibly 10 or more (Haiti Regeneration 2010). As funds and technical assistance are focused on post-earthquake recovery, there is a danger that programs to address the threats to biodiversity will go underfunded or unstaffed. An integrated approach that recognizes the importance of forests and stable watersheds in reducing the effects of natural disasters is needed to ensure the recovery efforts address long term solutions to the problem.

According to the Post-Disaster Needs Assessment following the earthquake (GOH 2010):

> ***Land and Resource Management*** *will be assured in order to counter the increased threat to the environment and natural resources resulting from the earthquake, and in order to reverse the tendency for these to be damaged, for the long term. In the short term, high-intensity labour to stabilise watersheds, including work to counter mass movements, clean coastal areas and rehabilitate and protect ecosystems will be undertaken. It will also be necessary to respond to the increasing demand for timber as a construction material, initially by favouring foreign imports as part of the humanitarian aid from forested developed*

countries and subsequently by implementing a national forestry programme as an initiative to restore the country's forest cover. Similarly, with a view to reducing pressure on timber resources, a shift from wood fuel to gas via appropriate taxation and subsidy measures is highly recommended. In the medium to long term, the strategy will aim to consolidate institutional and individual capacities in human, technical, physical and financial terms, with a view to ensuring effective management of watersheds, protected areas and coastal and marine zones in order to minimise pressure on timber resources and the reduction of vulnerability to erosion and flooding. Lastly, the need to incorporate adaptation and resilience to the present and future effects of climate change by reinforcing the management of ecosystems is equally important.

Landslides occurred during and after the 2010 earthquake, especially in the communities of Jacmel, Léogâne, Bainet, Petit Goâve, sometimes blocking or altering river flows. In places, high-altitude small mountain lakes have been formed. While new water sources have emerged, there is a risk of water pollution from the waste and debris generated by collapsed buildings and houses, and the risk of erosion is greater due to the increased instability of soil particles. The vulnerability of the population has increased because many earthquake victims have tended to take shelter on riverbanks and near coastal ravines (GEO Haiti 2010).

At Grand-Goâve and Petit-Goâve, coastal landslides have caused seawater to move inland. In other places, opposite phenomena have been observed. Due to the raised level of sea beds, coral reefs have emerged and can be seen above the surface of the sea (GOH 2010).

In the protected areas, particularly in Parc Macaya, farmhouses have been damaged or destroyed. As people emigrated from the disaster areas, an increase in the population in Protected Area buffer zones and increased prices for a sack of charcoal have been noted. This places greater pressure on the ecosystems, resources and biodiversity of the protected areas which may take the form of an increase in the number of farmed plots within central areas, the use of trees to build new houses and the fragmentation of species habitats (GOH 2010).

Some of the rubble from buildings collapsed by the earthquake is being dumped into the waters along the coast near Port-au-Prince. This is viewed by some as a means to dispose of the rubble as well as expand the area available for development. However, that coastal habitat is important to the biodiversity of Haiti and even if degraded areas are selected, the potential for restoration of mangroves and other marine ecosystems will be permanently lost.

Uncontrolled/unplanned disposal of sewage and hazardous waste has been a perpetual problem as there is no official sewage or hazardous waste site in the country. Such wastes are being dumped many in waterways or ravines, which has major impacts to coastal biodiversity. Birdlife International (2010) noted that Lake Azuei is polluted and because of the adjacent transnational road the lake is being used as a solid waste area. Nationwide, waste dumping was a serious problem before the earthquake, but it was somewhat dispersed. Now with the many resettlement camps and villages starting to be built there are the cumulative impacts of concentrated sewage waste and hazardous waste from the rubble collection (especially oils) being dumped haphazardly into waterways.

An indirect, yet serious effect of the earthquake on biodiversity is the loss of management capacity by the Government of Haiti. When the offices of the Ministry of the Environment collapsed, people, equipment, records and years of preparatory work were lost. Understandably, the immediate needs for humanitarian relief became the priority of the government and non-governmental organizations. The consequence of the loss of institutional capacity is that previous lax regulation of environmental laws and management of protected areas have now become almost non-existent. Progress that was painstakingly made with decades of effort has been severely set back in many areas.

5. REVIEW OF DRAFT USAID FIVE YEAR STRATEGIC PLAN, RECOMMENDATIONS AND PROPOSED ACTIONS

The earthquake of January 12, 2010 was the worst humanitarian and economic disaster recorded in the Western Hemisphere. Consistent with the Government of Haiti Action Plan, the USG's reconstruction and long-term development plan seeks to support new and diverse economic opportunities outside of Port-au-Prince using focused and catalytic investments in housing, energy, agriculture, health, security and national and local governance.

5.1 Strategic Framework

The draft post-earthquake US Government Haiti Strategy is based upon the following strategic framework:

5 Principles

USG assistance will be country-led and build country capacity
USG assistance will be comprehensive and integrated
USG assistance will leverage and be coordinated with the resources of other partners
USG assistance will leverage multi-lateral mechanisms wherever appropriate
USG assistance will be sustained and accountable

4 Core Development Pillars

Infrastructure and Energy
Food and Economic Security
Health and Other Basic Services
Governance and Rule of Law

3 Development Corridors

Port-au-Prince Corridor
Saint Marc Corridor
Cap Haïtien Corridor

2 Objectives

To catalyze economic growth through investments in agriculture, energy and infrastructure
To ensure long-term stability through investments in public institutions

1 Goal

A stable and economically viable Haïti

Impacts to Biodiversity of the Five Principles of the USG Strategy

The five development principles set forth by President Obama at the G8 summit in L'Aquila, Italy in 2009 will ensure maximum impact and sustainability for the US Government strategy. While not directly linked to biodiversity and tropical forests, these principles will ensure that those portions of the framework that do impact biodiversity and forests are appropriately designed and effective.

Impacts to Biodiversity of the Four Core Development Pillars

The four development pillars show how the US Government will focus its investment and efforts toward achieving economic growth and stability for at least the next five years. Thus, these pillars are the key to assessing how the strategy will affect biodiversity and forests in Haiti.

The various governments, agencies and organizations operating within Haiti have recognized that in order to protect and restore the environment and biodiversity of Haiti, there must first be an improvement in the economic security and living standards for the people of Haiti. Until that time, people living in poverty without alternative sources of income will continue to use the natural resources of the country to survive from day to day, often with long term detrimental effects to the environment. Thus, the focus of the four pillars on achieving economic growth and stability can work toward providing alternatives to unsustainable land use practices, thereby providing an indirect benefit to the environment. How those four pillars are implemented can greatly affect the magnitude and extent of the benefits as well as whether individual projects may have unintended detrimental effects.

Pillar A: Infrastructure and Energy

The focus for the infrastructure portion of this pillar will be on housing and ports. Improving existing neighborhoods and replacing transitional shelters with permanent, hurricane and seismic resistant housing are not likely to directly affect biodiversity and forests on land that had already been developed. However, there are potential indirect effects that may result from actions such as the selection of types and sources of building materials. Disposal of rubble as the sites are prepared can negatively affect biodiversity if disposal sites are not carefully selected. Team members observed rubble disposal on the coast north of Port-au-Prince in what had once been mangrove forest. Whether mangroves were covered by the rubble is uncertain, but even if not, the loss of mangroves from that site has now become permanent. Therefore, careful attention should be paid to rubble site selection in Project Environmental Assessments for rebuilding activities.

Similarly, supporting the creation of safe and sustainable communities in Government of Haiti designated development corridors can be done with minimal impacts to tropical forests if site

selection takes into consideration important coastal ecosystems and indirect effects, such as displacing agriculture from fertile soils (thereby increasing pressure on the hillsides) or increasing populations near habitats of vulnerable species, thereby increasing potential poaching of wood and animals. The integrated approach of combining job creation with the development corridors will reduce the risk that people will have to resort to unsustainable uses of natural resources and therefore will help minimize the potential impacts to biodiversity.

The development of a major international container port has the potential to affect coastal and marine resources, such as mangroves (especially at Lafiteau) and coral reefs. Mangroves and coral reefs were identified in Section 2.1.2 of this report as being highly important for biological diversity. Therefore, careful attention must be paid to coastal and marine resources during port site selection and in project environmental impact assessments for port development activities. Each of the potential sites identified in the Strategic Framework have nearby mangroves and coral reefs that must be taken into consideration. Opportunities for enhancement of biodiversity could be realized by incorporating mitigation measures such as the creation of a marine protected area or offsite mangrove restoration into project design.

The focus for the energy portion of this pillar will be on electricity provision and alternative cooking technologies. Modernizing the electricity sector, as well as improving the generation, transmission, and distribution of electricity has great potential for positive effects on the standard of living in Haiti with relatively low impacts on the environment. However, expanding the generation of electricity through new construction can have serious consequences to the biological diversity of Haiti, depending on site selection and mitigation measures implemented. Also, if hillside stability and forest protection is not implemented, the lifespan of these electrical plants will be minimal.

Alternative cooking technologies have the potential for significant indirect benefits to biodiversity and forests in Haiti. As discussed in Section 2 of this report, cutting trees and shrubs for fuelwood and charcoal is one of the primary causes of deforestation and environmental degradation in Haiti. Achieving a large-scale reduction in consumption of charcoal and firewood by households, food vendors, and energy-intensive businesses would greatly reduce the pressure on the remaining native forests as well as woody vegetation needed to hold the soil on steep hillsides. The objective to generate incentives and awareness among consumers of alternative cooking technologies and fuels, offer financing and technical assistance to entrepreneurs to develop supply chains of cleaner fuels and cooking technologies, and help move consumers from the existing firewood and charcoal supply chains to the new supply chains addresses concerns that the team has heard from many people throughout the preparation of this assessment. The WINNER Project has already taken action in promoting the use of LP gas through providing subsidized stoves and tanks to restaurants, dry cleaners, and street food vendors.

Pillar B: Food and Economic Security

The focus for the food security portion of this pillar will be on agriculture and nutrition. The strategy recognizes that working in an integrated fashion at the watershed level will ensure that

investments made in irrigation in the lower watershed are supported by interventions in the upper watersheds to better manage water flow and use, and to prevent soil erosion and corresponding losses in yields. Land degradation and soil erosion were discussed in Section 2 as a serious threat to biodiversity in Haiti, due to the effects on river and marine ecosystems. Placing a higher emphasis on reforestation and environmental restoration in the upper watersheds would benefit biodiversity and tropical forests.

The economic security portion of this pillar is predicated on people having secure livelihoods. This objective could provide people with alternatives to unsustainable land use practices, thereby providing an indirect benefit to the environment. Encouraging the development of eco-friendly micro and small enterprises would enhance the likelihood that this pillar would provide benefits to biodiversity and forests in Haiti.

Pillar C: Health and Other Basic Services

Improvements in health and education can have benign or positive effects on biodiversity, depending on project design. For instance, improvements in sanitation can reduce environmental degradation if they are designed to prevent contamination of river and marine systems. Incorporating an environmental sensitivity aspect to education programs could have immediate and long term benefits to biodiversity. Strengthening those aspects would enhance the likelihood that this pillar would provide benefits to the biodiversity and forests in Haiti.

Pillar D: Governance and Rule of Law

U.S. government policies and programs under Pillar D work to support more responsive governance and improved rule of law in Haiti. The goal of USG assistance in governance is a more responsive Haitian government increasingly capable of performing essential governance functions without reliance on international assistance. The end goal for US Government investments to support Haiti's Rule of Law over the next five years is the emergence of a Haitian state increasingly capable of ensuring the rule of law and the protection of vulnerable populations throughout its territory.

According to the Post-Disaster Needs Assessment following the earthquake (GOH 2010):

> *In terms of **environmental governance**, it is vital for the environmental concern to be placed at the heart of decisions relating to the process of recovery and reconstruction, with a view to sustainable development and enhanced security for the population. In this respect, the political role of the Ministry of the Environment and its multi-sector normative power should be ensured by means of an organic law and, more generally, a strengthening of its capacities. This will enable it to (i) exercise its functions of oversight, control, assistance and consultation as well as (ii) be actively involved alongside civil society in roundtable discussions regarding recovery process coordination and planning; reconstruction.*

While improvements have been made in the legislation for protection of biodiversity and forests in Haiti (Section 3.2.1), as was discussed in Section 2.4, one of the main threats to biodiversity and forests in Haiti is that enforcement of existing laws is essentially non-existent. Even general improvements in governance and rule of law would strengthen the ability of the Government of Haiti to protect biodiversity, forests and protected areas. Adding specific goals to address biodiversity in governance and rule of law would respond to a critical need in Haiti.

The implementation of all activities within these Pillars needs to be based on sound environmental planning and design that takes an integrated resource approach and ensures the conservation of biodiversity and tropical forests. The preparation of Environmental Assessments and identification of potential impacts and necessary mitigation measures will promote the security of the natural resource base (of which species and habitat biodiversity, as well as tropical forests, are part) that is the foundation for sustainable development.

The new strategy and 2 objectives do not directly address the management of natural protected areas, biodiversity conservation, and restoration of buffer zones surrounding protected areas. Pillar B only addresses these issues many through indirect actions such as livelihood activities and reforestation tied to agriculture production-i.e. economic growth is the primary focus. In short, the new strategy is attacking the issues in part and not as a whole integrated approach. Thus, collaboration with other agencies and organizations listed in the above section that are directly working on tropical forest and biodiversity protection and management will be essential. Together, a complete package for biodiversity and tropical forest conservation could be implemented.

Impacts to Biodiversity of the Three Development Corridors

Each development corridor will be anchored by one or two critical watersheds within the corridor boundaries. USG supported agricultural investments in each of these watersheds will both counterbalance and fuel the industrial and commercial growth in the pole cities. While this strategy will support vital basic services and public institutions, the animating ambition of the new USG strategy for Haiti is economic growth.

As has been repeated throughout this assessment, in order to protect and restore the environment and biodiversity of Haiti, there must first be an improvement in the economic security and living standards for the people of Haiti. The activities to be implemented in the three development corridors will work toward that general goal. However, a great opportunity to protect, promote and enhance the biodiversity of Haiti will be lost if the successes of past projects that addressed soil conservation and protection and restoration of natural resources are not carried forward into the current strategy.

For example, the upper reaches of the Cul de Sac watershed include a portion of La Visite National Park and the Forêt des Pins. USAID has funded studies of biodiversity and management opportunities at La Visite National Park in the past (Woods 1986, Timyan 2009); those investments of time and funding should be followed by further inputs into the management

and protection of this important area of biodiversity. The WINNER project has provided some support toward resource protection at the park by contributing fencing, but much more work needs to be done. The team highly encourages USAID/WINNER to review and incorporate the recommendations of the La Visit National Park and WINNER Management Strategies (Timyan 2009). Those recommendations include:

> Recommended activities in the buffer zone include 1) organizing slope stabilization and agroforestry interventions among landholders, 2) supporting the diversification and productivity of farm/non-farm enterprises, 3) facilitating the establishment of tree/plant nurseries, 4) facilitating social and financial services, supply stores and farmer training to target landholders and 5) studying the feasibility of incentive-based contracts to pay for ecosystem services. Recommended activities in the escarpment are 1) strengthening the coordination and capacity of the Corps de Surveillance, police and volunteer watch brigades to control encroachment activities, 2) determining the lower elevation park boundaries at approximately the 1500 m contour, 3) conducting an inventory of the extent and status of remaining cloud forests, 4) identifying and prioritizing the micro-basins that are the most vulnerable to disturbance, 5) presenting the findings to government bodies including the Ministry of Environment and local government councils, 6) determining a strategy to halt encroachment of escarpment forests with mandatory and voluntary sanctions, 7) determining the feasibility of MDE-sanctioned carbon offsets, 8) determining the feasibility of co-management agreements between MDE and local CBOs to protect the escarpment forests and 9) developing recovery plans for endangered species with current universities and conservation organizations active in the area.
>
> Recommended activities for the entire park include 1) participating in the planning of the park management plan, 2) identifying major laws and reforms needed to resolve the legal status of park residents, 3) assisting in developing a strategy to determine park boundaries, 4) liaising with the implementation of ANAP and 5) providing assistance to MDE park service to improve administrative and operational efficiencies

Extending the WINNER zones of intervention to include the entire La Visite National Park, and preferably the Forêt des Pins Reserve as well, would greatly increase the benefits and likelihood of success for those actions. DEED has been active in the Limbé and Cabaret watersheds and efforts toward mangrove restoration and creation of marine protected areas have had initial successes, but the great potential of those efforts will be lost if the focus now shifts to other objectives.

The team has heard throughout its mission that many of the mistakes of early development projects were addressed in DEED and further improvements were made with the WINNER initiative. Hillside stability activities by the International Organization of Migration and the Cooperative Housing Foundation through the JOBS program have had excellent results through community collaboration and participation. Improvements in involving national and local government agencies, community interest groups, and negotiating “ownership” in project goals has made a difference in the sustainability and effectiveness of projects. Addressing sustainable development with a ridge to reef strategy has been shown to be effective at specific points of action, but the work is not yet complete. Erosion control structures and Agroforestry projects are stabilizing the soil on many hectares, but there are still millions of hectares in need

of rehabilitation. The same effectiveness on a limited scale is true of mangrove restoration. The trend towards increased effectiveness in addressing the needs of people and the resource should be continued and addressed in the current strategy.

The two Development Corridors that abut the Dominican Republic border should address the loss of biodiversity on the island of Hispaniola due to the deforestation for charcoal production. Biodiversity and habitats know no country borders; USAID Haiti and USAID Dominican Republic must coordinate the planning of conservation and livelihood activities along the border, together with other organizations working in reforestation/restoration of watersheds along the border, in order to have a greater positive impact on the conservation of biodiversity for the island.

Impacts to Biodiversity of the Two Objectives and One Goal

Achieving the US Government's two objectives in Haiti – economic growth and long-term stability – includes constant monitoring and information regarding progress, success and failures and an ability to be fast, flexible and innovative. The Strategy will be subject to rigorous monitoring and evaluation and the USG will aim to do business differently, delivering focused impact to meet urgent needs while building local capacity for longer-term sustainability.

Monitoring and documentation of successes and failures of early reforestation and environmental restoration projects was noted as an area needing improvement by this team. More recent projects have had good immediate post-project monitoring, but long-term follow-up monitoring and evaluation is still needed to determine whether lasting benefits are being achieved.

The goal of a stable and economically viable Haiti is directly related to the two objectives. Economic growth and long-term stability will have indirect benefits to biodiversity by providing people with alternatives to unsustainable agricultural practices. However, unless the rapid degradation of the environment of Haiti is addressed, truly long-term stability is unlikely to be achieved. The natural resource base (productive soils, clean and adequate supply of water, productive coastal resources and fisheries, and sustainable vegetative cover) is the foundation of economic growth in Haiti.

5.2 Recommendations and Proposed Actions

In addition to the beneficial aspects of the strategic framework discussed in Section 5.1, the following actions would enhance the effectiveness of the strategy in protecting and enhancing biodiversity and tropical forests. Each of these actions can be incorporated into the Four Pillars and would be appropriate activities for USAID biodiversity funding.

- Continue efforts toward the establishment of the Arcadins Marine Protected Area and provide technical assistance and support for MDE efforts for additional Marine Protected Areas at Caracol, Petit Goâve, and Baradères.

- Continue the current ridge to reef approach in each of the four watersheds within the three development corridors.
    - Emphasize reforestation/revegetation and environmental restoration in the upper watersheds to benefit biodiversity and tropical forests. Also, implement the same along the border of Haiti and the Dominican Republic in collaboration with UNEP, UNDP, NORAD, and IDB, for the protection of Hispaniola biodiversity.
    - Add a mangrove restoration component to the watersheds.
    - Provide assistance for the assessment (inventory and monitoring), management and protection of the Important Bird Area at Étang Bois Neuf in the St. Marc Development Corridor.
- Enhance the effectiveness of the alternative cooking technologies program by launching a public awareness campaign. This should include the benefits of the stoves, as well as the effects of deforestation and cutting for resin chips (bois gras). Expand the efforts of WINNER throughout the 3 Corridors to promote the use of LP Gas, biogas/biodigesters, and improved charcoal stoves. Priority should be on high consumption business such as restaurants, dry cleaners, street vendors and urban centers.
- Incorporate environmental sensitivity in education programs.
- Add specific goals to address biodiversity in the governance and rule of law pillar.
    - Provide support, technical assistance, equipment, and funding for improved rule of law at established protected areas, especially La Visite National Park.
    - Coordinate with the Ministry of the Environment during the early planning phases of all projects and ensure entities contracted or funded by USAID to implement projects have coordinated with the MDE during their planning.
- Extend the boundaries of the Port-au-Prince Development Corridor (Cul de Sac Watershed) to include the entirety of La Visite National Park and the Pine Forest Reserve (Forêt des Pins). Use USAID Biodiversity funding to support park infrastructure, staffing (including enforcement), management, monitoring, governance and rule of law, as well as other actions recommended in La Visit National Park and WINNER Management Strategies (Timyan 2009).
- Ensure that all activities within the New Strategy Pillars are implemented following Regulation 216 Environmental Compliance direction and that Environmental Assessment and Environmental Mitigation Plan and Report recommendations/mitigations are completed, implemented, and monitored. This will require that the mission have adequate environmental personnel capacity to handle to extensive environmental compliance workload of the Pillar activities.
- Collaborate with UNEP and Ministry of Environment to form an environmental planning and management committee that would serve to review major infrastructure developments with sensitive ecosystems and promote biodiversity, tropical forest conservation, and climate change adaptation actions. This committee could serve as the

representatives for the Caribbean Biological Corridor program and oversee the implementation of the Program's activities within Haiti. The USAID Haiti Mission Environmental Officer could represent Haiti on this committee.

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Appendix 1. Meetings and Site Visits During the Preparation of the Haiti Assessment of Biodiversity and Tropical Forests

25 October 2010

Meeting with **Antonio Perera**, Country Program Manager, **UNEP** Haiti. antonio.perera@unep.org (509)2813-1539. A primary UNEP focus is coastal/marine biodiversity. At the western end of the southern peninsula of Haiti, Les Cayes is being targeted for a Marine Protected Area with two areas of strict protection. The area around Baradères Peninsula and Cayemite Islands is also important for biodiversity and should be a Marine Protected Area. Both areas have significant coral reefs that should be protected. Along the north coast of Haiti, the area near Labadie has ecotourism potential, due to the weekly stops by Royal Caribbean Cruise ships, bringing more than 5,000 people. This could be used to promote the need for marine protected areas.

There is a project underway to establish a Caribbean Biological Corridor linking significant biodiversity areas in Cuba, Haiti and the Dominican Republic. The project is currently sponsored by UNEP with EU funding a $4 million grant. An office has been established and staffed in the Dominican Republic.

Green Border (Frontier Vert) is a DR reforestation project extending to the border area. Norway has provided $2.5 million for reforestation brigades to plant trees. The situation is more complex in Haiti, since there is a need to first address land tenure and alternative sources of income, otherwise reforestation efforts will not be successful. There are two focus areas in Haiti for Green Border – the North and South ends of the border. GEF, PET and others in the Artibonite will take care of the central portion.

The Haiti Regeneration Initiative is being funded by Norway ($8 million) and will be a regional approach, but they want to start with Southern Haiti to show some successes. There will be a new document coming out in January.

The National Capacity Self Assessment has been drafted. This is required by GEF and must assess the capacity to comply with compromises in the BCD, CCD and CCC conventions for Haiti. The MDE general director is responsible for this report and has hired a consultant.

27 October 2010 AM

Meeting with **Astrel Joseph, MDE**, Director of Soil and Ecosystems (509)3455-1626 astreljo@yahoo.fr and **Ernst Laraque, ONEV and former Minister of the Environment**. The Agence National des Aires Protégé (ANAP) is not yet functional, but the SNAP (System National des Aires Protégé) concept is being promoted through UNEP. Two new transitional organizations have been formed. The UMO (Unité de

Mise en oeuvre de l'ANAP) which is responsible for creating the legal and operational framework for the SNAP and the CMO (Commission de Mise en Oeuvre de l'ANAP) is responsible for validating UMO's work. The CMO is composed of representatives from various Ministries and international agencies who have been working to strengthen the institutional system, which should also result in ANAP becoming functional. The thought is that UNEP will provide the resources and ANAP will make SNAP function.

Important programs promoting or protecting biodiversity in Haiti include Forêt des Pins Unit II; the CIDA (Canadian International Development Agency) funded anti-desertification project along the DR border; USAID funded WINNER project; surveillance programs at La Visite; Helvetas (Swiss) socio-environmental work; IDB funded Macaya biodiversity project; Fondation Sequin; and the tri-national Caribbean Corridor Project. The Caribbean Corridor Project is designed to promote a corridor of protected areas linking DR, Haiti and Cuba. There is an IUCN funded office in the DR with a staff of three. The staff was hired by a selection committee comprised of 1 Haitian, 2 IUCN, 2 Cuban, and 2 DR panelists. The primary funding for the corridor project will be from the EU.

There are no Marine Protected Areas yet, but there is an initiative at Petit Goâve, with socio-economic and environmental awareness activities. The Caribbean Corridor will also include some coastal areas, such as Baradères, which will protect mangroves and include local initiatives through UN funding.

Agroforestry and soil conservation projects noted include the AECID funded Araucaria XXI-Haiti Phase III for La Visite planning and reforestation at Belle Anse, Forêt des Pins (Helvetas), La Visite (WINNER), Macaya, Forêt des Pins Unit I (World Vision), Caribbean Corridor, and the Artibonite Projects. There is a regional nursery for *Pinus occidentalis* for the border area, as well as other nurseries. The Artibonite Project is focusing on green energy and reforestation with native species. Watershed approach.

A two-part recommendation from Mr. Joseph:

1. More emphasis on local strategy of MDE and its agencies in local areas. Not just in funding, but also in the planning of projects. That is, before funding a project, include MDE in the planning.

2. Funding institutions should ask an institution requesting funds if the local agency is involved and they have incorporated local issues and concerns. After the project is funded, the terms and conditions are set and it is too late for the agencies to influence the projects.

These relate to all funding agencies. USAID has had some projects in the past where the Ministry and agencies were not fully involved, but WINNER is and example of a project that had good involvement, so they think USAID is improving in their communications.

Threats to Biodiversity.

1. Alternative energy is needed to reduce pressure on the environment.
2. Human habitation in protected areas. Alternatives need to be provided for resettlement.
3. Agricultural practices – erosion affects productivity and downstream areas. Soil stabilization is needed in agricultural areas. Some improvements are being made. Many reports note that <2% of Haitï is forested, but if you include palm plantations, agroforestry, mangoes and other areas with trees, it may be more like 19% cover.

27 October 2010 PM

Meeting with **Phillippe Bayard** (509)3448-0853 phbayard@yahoo.com and **Jean Vilmond Hilaire** 2940-4576 hvilmond@yahoo.fr of **Haitian Audubon Society**. Société Audubon Haiti has primarily been involved at Macaya National Park since 2006. They developed a needs assessment and are involved in socio-economic and livelihood improvement in the Pic Formon area. They have improved the water supply, and developed schools (with environmental education programs) in 5 communities. They have developed nurseries with >60,000 trees planted. They have agreements with the communities that in return for the development projects, the communities will stop cutting the forest and now 70% of the forest parcels have been abandoned. IUCN is training park personnel. IDB is funding Macaya as a biosphere reserve.

Hilaire noted that there were significant improvements in the field of biodiversity regarding the coordination between stakeholders. He thought that nowadays there are more local experts involved in the discussion and planning as opposed to the past.

There are 4 parks in Haiti: Citadel, Forêt des Pins, Macaya, and La Visite. There are > 30 protected areas on paper, but they aren't really protected. Some of them are Important Bird Areas and Audubon Haiti works with Birdlife International to provide information. Once SNAP and ANAP are functional, they will be important to protecting areas. Local partners are needed as well.

Monitoring vertebrates is important to biodiversity. The National GIS center (CNIGS) can help with geospatial aspects of biodiversity monitoring and mapping protected areas. Penn. State also did a herp assessment at Macaya (*note: Blair Hedges received a $200k NSF grant in 2009 to study the endangered vertebrate fauna of Haiti*). Macaya has 14 endemic frogs, one of which was just discovered last week.

Strategic Objectives for Audubon Haiti:

1. Inventory and Monitoring

2. Livelihood improvement of parents

3. Social opportunities for the future for the children. The school has a nursery capacity of 50,000 plants, which teaches skills and has protected 18 hectares.

There is no legal park boundary. The legislation only says 2,000 hectares are protected, but doesn't specify exactly where the lines are. Therefore people don't know and encroach into the forested areas.

Recommended contacts: Yves Duplan (3760-4578) and Edna Civil (3694-6950) of UNDP. Martine Mathieu, CNGS (3405-0604). David Palacios, AECID (3779-8724) for La Visite and the Araucaria XXI-Haiti Phase III project.

Hilaire was upset that USAID programs continually pour money into projects with no results. This makes it difficult for small organizations to get local people to work on projects. People either want more

money, or they become disillusioned by the failed projects and don't want to cooperate. Both Hilaire and Bayard agreed that DEED and WINNER were improvements from past programs.

28 October 2010

Site Visit to **Lac Azuei and Source Zabeth** and meeting with **Arnoux Severin** . The PET program includes a 5,000 Km^2 watershed improvement project comprised of Lac Azuei (1,500 Km^2) and Lac Enriquillo (3,500 Km^2) in the DR. Lac Azuei has a surface area of 115 Km^2. The density of inhabitants is about 300/Km^2 when there really only should be about 75-100/Km^2. There has been a severe reduction in wet pine forest and dry forest due to agriculture and deforestation. The steep slopes of the watershed erode after deforestation and cultivation and the sediments wash into the lake. The lack of forest cover leaves less water holding capacity and lowers the infiltration rate, so much more water than usual flows to the lake. The lake level has risen dramatically, flooding many wetlands, buildings, palm groves, and even formerly dry Prosopis scrub land. The road to the DR border is under water and they are cutting into the hillsides to build up the new road as the water rises. The gravel mining areas in the hillsides sometimes cave in (some workers have been killed) indicating landslide problems are likely to become even worse over time. There have been a few erosion control or soil stabilization projects, but nothing covering a significant portion of the watershed. There was a small bamboo planting project, some private mango plantations and the WINNER project is planting Jatropha.

According the director of PET there are several threats to biodiversity in the Lac Azuei watershed, which are agriculture encroachments, forest fire, and the rising of the Azeui water level. Several plant species have disappeared or are in the process of disappearing in the watershed due to uncontrolled agriculture encroachments and overexploitation of natural resources. The flooding of the coastal areas of the Lac Azuei is threatening palm trees, mangroves and *Prosopis juliflora*. There is drastic change in ecosystem from the sea level where agriculture is predominant up to higher altitude where there are areas of various forest cover types and density.

Source Zabeth is a relic tropical forest that had 82 species on <10 ha. Alain found a book that reported it to be 4 ha. It is being developed for ecotourism, but some of the biodiversity has been lost as they have channelized the stream with cement and rock walls and cut the understory out of part of the area to open it up for visitors. We were told that there are 17 protected springs in the area.

29 October 2010

Site Visit to **Forêt des Pins Unit I**. We were unable to reach Claude Phanord of Helvetas by telephone, so we went to the reserve and asked the people at the town of Forêt des Pins. **Sadrac Désire**, a former student of Alain's was there and told us Mr. Phanord worked at Unit II, near La Visite Park. Sadrac works for FLM on a sustainable development and capacity building project and he offered to show us around. They are working on erosion control, agroforestry, reforestation, and organization. The reforestation

project uses seedlings found in the forest and transplants them. In two months they planted 56,000 seedlings on 50 hectares.

Sadrac said the forest is not being cut where there are guards, but people will still cut trees away from the guarded areas. He told us that people will light fires sometimes, but he believes most fires are natural origin. They do fuel reduction pruning and slash removal. There is very little woody debris on the forest floor, which is important to biodiversity. The recently burned areas do not have much understory. There is no animosity towards forest guards except by people that are caught cutting trees. Sadrac worked in the area 3 years ago and said the forest has changed a lot and he used to hear birds that are not there anymore. The Ministry of Environment is building 10-12 guest houses for ecotourism. There is a large water catchment and cistern, since there is no other source of water. Arrangements for the guest houses will have to be made through the Ministry, once the project is running.

We also spoke with a group of people headed for an erosion control project. They said they value the forest, but there are people who don't and cut the trees. They use the forest for medicinal plants and pasturing. One said when he was little the forest was so thick it was scary and many people wouldn't go in. Now it is very open and birds have left the area. When asked what would be the best way to protect the forest, they said it should be a community decision. They thought that having guards spread around the forest, rather than in one place would be better protection and create more jobs.

4 November 2010

Mike Godfrey, DAI, discussed the **DEED** project and showed us some sites in the **Montrouis watershed**. The DEED project had set deliverables that included training, producer groups, and improved agriculture. The producer groups, cocoa production and beekeeping are notable successes of the DEED project. There are no specific areas to visit in the Montrouis watershed to see DEED project soil erosion control, reforestation, or other project activities. They are more focused on capacity building and training. The Maier of Bas Limbe has decreed the mangroves to be protected from cutting and DEED has helped establish nurseries and mangrove reforestation in that area (Limbe watershed). An arête has been drafted for a Marine Protected Area along the Montrouis watershed coastline, but it has been waiting to be signed for almost a year. DEED staff discuss the importance of the Étang Bois Neuf at their community meetings and urge people to stop shooting the waterfowl, practice sustainable fish harvest, and not do recessionary cultivation (farming the wetlands as the water recedes). When we visited Étang Bois Neuf there were people tilling the wetlands and a fisherman checking his fish trap. Black necked stilts, snowy egrets, a great egret, little blue heron, killdeer and other shorebirds were present.

The Monastery of St. Benedictine is a walled compound that provides protection for a patch of natural forest. There are exotic species present and some areas were probably cut in the past and are regenerating, but the species diversity is high and the forest cover is a striking contrast from the surrounding scrublands. The coastal mangroves are scattered and small patches. Mike says there are good areas of coral out from shore, but nearshore has been degraded and mostly consists of soft corals and a few scattered clumps of hard coral. I have also noticed that at Indigo Beach.

Mike believes traditional reforestation will not work because it is very expensive to haul trees to the steep uncultivated areas and then there is a high likelihood that once they are planted the seedlings will be trampled or eaten by cattle or goats.

Opportunities: Protection and management of Étang Bois Neuf, promote signing Marine Protected Area legislation.

5 November 2010

Telephone conversation with **Joel Timyan** jctimyan@gmail.com Étang Bois Neuf has tilapia, which may be stocked by the government from time to time. The government may have (not sure who) contracted a study of native species in the pond, but the contractor didn't really know native species of fish well, so it didn't proceed. The pond dried completely in 2008, so it isn't a permanent lake, but it is recolonized by native species from the stream. Rezo Ekolo (sp) is another Haitian environmental group that is becoming active. Specialists knowledgeable of Haitian flora/fauna are: Goetz – black capped petrel, Woods – mammals, Jean Wiener – Navassa marine biodiversity, Judd – flora, Hedges – herps. Hedges captured 154 herp specimens for their captive breeding program.

9 November 2010

Northeast Haiti site visit with **Jean Claude Pierre Louis**, Senior Specialist in Natural Resources, **USAID/DEED DAI Contractor**. Jean Claude explained the ecosystems of Northern Haiti and showed us the mangroves at Caracol and Ft. Liberte bays. The mangroves are fragmented and altered by cutting, but still provide important fish habitat. A group of men from a fishing village came to talk with us at Caracol and said they chase people away when they see them trying to cut the mangroves, but they don't always catch them. People come by boat and sell the wood to bakeries, dry cleaners and other businesses in Cap Haitian and other towns.

We met with **Ronel Ceran** of **UNDP/FEM (GEF) Small Grants Program**. Ronel has a $600,000 budget which will increase by $2 million next year. The small grants are limited to $50,000 from GEF, but the total project can be more with co-funding. Projects are approved by a committee in PaP. Ronel has 18 projects now and anticipates approval of 12 more by the end of the year. The program has 5 main areas they seek to address:

- Biodiversity
- POPs
- Desertification
- Climate Change
- International waters

Notable successes are a hone project, product transformation project by a women's group, and tree planting. Ronel believes a holistic approach is needed, which is tied to the socio-economic situation of the local people.

A message from Ronel to USAID: Small is beautiful, but thousands of small projects must be funded. Don't fund agronomists, analysists, directors and studies. Get the money to the people.

Ronel believes, there are many opportunities for co-funding. The small grants project is limited to $50,000, but with co-funding, much more can be done.

Constraints on big project success includes limited life of projects, lack of government presence throughout rural Haiti, and the lack of resources for those who are in rural areas.

A French NGO and US based One Village Planet (Dan Warren) are helping with the tree planting project and mangrove restoration.

The mangrove project includes restoration and agriculture behind the mangroves.

Coffee growers are using shade grown varieties and are seeking biologic (organic?) certification. Seeking bird friendly certification through the Smithsonian Institution would also be advantageous.

The dry, non-agricultural areas are used for charcoal production and grazing. By planting 30-50 ha woodlots, they feel they can ensure project success.

Small scale vs. National scale: Community based projects have buy-in. National based projects have a lack of protection and there is no national forest management plan. Organization of community groups is a problem that will happen with each group. A training program with technical assistance from USAID was mentioned as a possible niche.

Charcoal co-ops would help. Production/transport lines are in place, but they need to determine how to get certified charcoal to the market and identified as such.

10 November 2010

Visits to DEED projects in the Limbe Watershed.

Bas Limbe mangrove restoration project. The local Maier has issued a decree that the mangroves are to be protected. Local people are no longer cutting and are volunteering to be guards. There is a nursery and a restoration area in which young mangroves were planted. Grazing is still a problem and may affect the survival of the plantings.

Cocoa project with fruit and oak trees in the overstory and a goat enclosure project in which food is brought to the goat instead of having them roam free and degrade the hillslopes (cut and carry system). Providing water to clean the pens is a problem that the manager says DEED should provide, whereas DEED staff thinks those benefitting need to put more into the project and have ownership.

We visited a project aimed at controlling erosion in hillside farming plots. A great deal of discussion focused on whether growing perennial forbs constitutes permaculture and whether growing trees and woody crops, such as pineapple, fits the needs and desires of the local farmers. The trenches being dug need to be maintained when they fill with soil, but at this point, the farmers prefer that to the "banne manje" concept of growing annual crops next to bands of trees, sugar cane, etc. which they say block their ability to clear the trenches and result in gullies forming where the runoff breaks through.

A local farmer had also established a tree nursery for commercial sales. Species selection is primarily focused on fruit trees and some for charcoal production.

We visited an Agricultural Training center, which was currently vacant, but has some training sessions starting in the near future. The center needs to be updated with current equipment, such as computers and GIS capabilities, in order to attract students. Donor funding could help renovate the center and a good niche would be training focused on agricultural practices that prevent ecosystem degradation, as well as environmental restoration techniques.

11 November 2010

Meeting at Fondation Seguin office with **Christian Novak of DED** (German Development Service); **Winthrop Attié (Winnie) of Fondation Seguin** and owner of l'Auberge de Seguin; **Immanuel** who is a forester working with DED; **Roland Finis Agricultural Technician** and the nursery director for the DED project; and **Jean Claude Exantus, president of MJPK**, the grass roots organization for Casse-Dent community.

Fondation Sequin, with the help of DED have been running an environmental education course called École Vert (Lekol Vet in Creole). It is a 3 day class put on each month September through June, with one of the days spent planting trees. Each class has 35-40 kids from the La Selle range, but the current focus is on local kids. They have lost donors since the earthquake and need more donors. There is a four part video explaining the program on their Facebook page or at www.fondationseguin.org. USAID WINNER is listed as a partner in the video. The fourth video states that following the 2010 earthquake, hundreds of people took refuge at the National Park La Visite.

There is a bamboo planting project being funded by Taiwan and fences built by WINNER. Unfortunately, the bamboo was planted around pine saplings and has overtopped them. Winnie thinks that since the saplings are still alive, it proves that pine will grow under bamboo. However, the bamboo has not yet reached its full height or density.

The third area of focus is on prevention of hydrological catastrophes on or below the Seguin Plateau. They address this by:

1. Soil conservation structures in ravines and gullies.
2. Promoting eco-friendly commerce and sustainable use of the natural resources in the buffer zone. There is basically total land occupation, so they encourage apiculture, horticulture

(flowers for market in the city), chickens, compost production, a women's sewing business (about 10-20 women) to reduce pressure on the land and encourage sustainable uses.

3. Reforestation with native species, both in the pine forest and the Rak bwa or hardwood forest. This just began in May and the nurseries are established, but the rains of Tomas have damaged some of the seedlings and leached the soil.
4. PES = payment for ecological services. This started in July with 10 farmers. They pay 2000 gourdes/ha/year in quarterly payments for people to not cultivate in the forest.
5. Improved stoves – this will begin soon with tests of 3 types of stoves. 3Groups of 30 will try a stove, then switch to the next type after a certain time period, so they can compare and decide which will be best for their uses.

Winnie believes that if World Bank would provide subsidies for kerosene and propane it would decrease the need for wood and the pressure to cut the forest.

Jean Claude is president of MJPK, the movement of young peasants of Casse-Dent. They would like to have more guards for the forest and Park, but also knows everyone needs wood and that need must be addressed. He remembers the forest being very dense when he was young, with a thick understory. Now it is very open with no understory.

12 November 2010

Site-visit with **DED cadre, Immanuel** and **Jean Claude Exantus** to the **Casse-Dent** Payment for Ecological Services site for rak bwa (hardwood forest) and spoke with the owner, who said his father taught him the need for the forest to protect the springs that provide the water for the people below. Rock wall barriers have been installed below the PES site to control erosion. The walls were installed in May – August 2010 and some are already almost filled in with soil. A tree nursery has been established for native species, some of which will be interplanted in the protected hardwood forest site to enrich the species diversity.

Visit to **Galet Sek**, which is an area of springs high on the slope that provides the water for the rest of the Seguin Plateau. Galet Sek is within the La Visite National Park, but there are no guards and almost all of the surrounding trees have been sliced for bois gras, the resinous chips used to start charcoal fires. At the springs, people wash their clothes in the outflow, cattle and pigs graze and defecate in the wetland, and people have gardens upslope from the springs, in which they use pesticides. The soil is compacted from the uses and what used to be a marshy wetland is now damp solid ground. The compaction has decreased infiltration, which in turn results in faster runoff and flooding, followed by very low flows. The lack of protection in this critically important water source is indicative of the lack of protection and surveillance for the rest of the park.

A surveillance corps was sent to the park, but they were attacked (one was beaten) and threatened and left the area. Back at the Auberge, Winnie first said that the guards just didn't like living in the area,

which we also heard from Monica Novak, but when I asked Winnie about the attacks, he said it was true and he had to call in a helicopter to get the guards out of there. That is why he says the police should be the guards and there should be back-up. It is very hard to tell how much of the information from Winnie is credible.

Winnie's main recommendations:

- Bois gras should be made illegal and the police should seize it in the markets. There should also be educational announcements on TV showing the environmental effects of bois gras to convince people to use other methods to light charcoal fires. If you take away the demand from the cities, it would greatly reduce the cutting in the forest. He thinks this is a possibility for USAID.
- Address the needs of the people and provide alternatives so they don't need to encroach into the forest, such as is being done with the German DED and WINNER, but much more needs to be done.
- Increase the protection of the park through a strong police presence with arms, radios, back-up and enforcement ability. He thinks USAID should pressure the Ministry of Environment on this.
- World Bank should subsidize propane and kerosene to make it cheaper than charcoal.

16 November 2010

Meeting at the **Ministry of the Environment** with **Frantz Germain**, Civil Engineer, Specialist in Sanitation Engineering and Member of the Cabinet of the Ministry of the Environment (franzger@yahoo.fr). Mr. Germain attended the meeting in the absence of the Minister of the Environment, who was unable to attend due to duties related to the cholera epidemic.

Beatrice Pierre and Scott Posner gave a debriefing of the mission of the Biodiversity assessment and how it relates to the USAID five-year strategic plan. The structure of the assessment, information gathering, site visits, reporting and recommendation aspects of the assessment were discussed. Mr. Germain was also asked for input as to what was important to the Ministry in terms of biodiversity and cooperation with USAID. Mr. Germain agreed with the threats discussed and said the Ministry is also very concerned about the coastal environment, reducing impacts of development projects (such as a power plant being funded by Cuba near Carrefour) and the need to establish protected areas. He also said that alternatives to charcoal use are also needed to reduce the impacts on the forest. Mr. Germain took notes and said he would present them to the Minister, who would respond with more detailed comments.

Appendix 2. Scope of Work

Haiti Country Analysis on Tropical Forests and Biodiversity
For USAID/Haiti's Country Strategy (2011-2015)
July 21, 2010

I. Background

As part of the process for the new five-year Strategic Plan, USAID/Haiti is required by Sections 118 and 119 of the Foreign Assistance Act to complete an analysis of tropical forests and biodiversity in Haiti. A draft concept paper for the new strategy has been completed. Many documents, studies, and research on Haiti's tropical forests and biodiversity have been completed by many organizations during preceding years. This country analysis entails compilation, review, analysis, and synthesis of existing information; coupled with corroboration and feedback from major players. In order to integrate environment issues into Haiti's new strategy, it is necessary to conduct an analysis of the current status of tropical forests and biodiversity in Haiti, identify actions needed to conserve biodiversity and tropical forests, assess the current and planned activities of other donor programs and stakeholders in meeting these needs, and analyze the planned activities of USAID/Haiti in reference to the actions needed. A primary resource report is the May 2006 "Haiti Country Analysis of Tropical Forestry and Biodiversity" by D.B. Swartley and J.R. Toussaint. The current analysis to focus on changed conditions from the 2006 analysis. A list of existing documents is appended to the Scope of Work (SOW) in Annex 1.

Summary of relevant parts of FAA Sec. 118 and 119:

> From Sec. 118 Tropical Forests:
> (e) COUNTRY ANALYSIS REQUIREMENTS.—Each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of—
> (1) the actions necessary in that country to achieve conservation and sustainable management of tropical forests, and
> (2) the extent to which the actions proposed for support by the Agency meet the needs thus identified.
>
> From Sec. 119 Endangered Species:
> (d) COUNTRY ANALYSIS REQUIREMENTS.—Each country development strategy, statement or other country plan prepared by the Agency for International Development shall include an analysis of—
> (1) the actions necessary in that country to conserve biodiversity, and
> (2) the extent to which the actions proposed for support by the Agency meet the needs thus identified.

II. Purpose and Objective

III- Scope of Work

3.1 General Task

Under the direction of a team leader, the assessment team will evaluate biodiversity and tropical forest issues in Haiti, especially within the context of USG response to the earthquake that devastated Port-au-Prince, Haiti on January 12, 2010. The focus of all activities taken under this assignment is threefold: 1) Assess the conservation status of biodiversity and forests in Haiti; 2) identify actions necessary to better conserve biodiversity and tropical forests; and 3) describe how and to what extent actions proposed in USAID/Haiti's new upcoming Strategy and/or operational plans meet, or could meet, the biodiversity and tropical forest needs thus identified

3.2 Specific Tasks

The assessment team shall perform the following activities:

A. Data Collection

- Prior to departure, meet or phone the bureau environmental advisor, other Bureau for the LAC technical staff, and other Washington, D.C.-based organizations to gather relevant information on regional and Haiti-specific programs and agency environmental regulations.
- Obtain, review and analyze existing documentation on biodiversity conservation (and tropical forest conservation) in Haiti, such as that prepared by government agencies, bilateral donors, and national and international NGOs. Available online materials will be gathered prior to the country visit (links to known literature examples are shown in section VII).
- Meet with USAID/Haiti to get an understanding of the Mission's ongoing sectoral assessments, program goals and objectives under its current and proposed strategies. The Mission also may provide the team with advice and protocol on approaching USAID partners and host country organizations with respect to this assignment. The team will discuss organizations to be contacted and any planned site visits with the Mission and coordinate as required.
- Meet with and gather information from relevant ministries and agencies, donor organizations, international NGOs, and other organizations that are involved in forest and biodiversity conservation or other cross-cutting issues, or are implementing noteworthy projects.
- Conduct one to three priority site visits (WINNER, Title II, OTI, Resettlement sites etc..) , as necessary, to supplement the understanding gained from interviews, literature, and other second-hand sources.

B. Analysis

1. Summarize the status of biodiversity and tropical forests in Haiti.
2. Summarize the social, economic, institutional, legal, and policy context for their use and conservation, including actions currently being taken by government, other donors, NGOs, and the private sector.
3. Identify critical needs that should be addressed for the strategy to positively influence the conservation of tropical forests, biodiversity, and water resources and improve the sustainable management of natural resources in Haiti within the context of Haiti's reconstruction efforts.
4. Identify the key direct and indirect threats to biodiversity and tropical forests. Identify the actions necessary to conserve and sustainably manage natural resources, biodiversity and tropical forests in Haiti based on an analysis of country donor and NGO responses currently in place to meet these needs.
5. Analyze the existing Mission portfolio and proposed USAID/Haiti Strategy through an environment and climate change lens and identify some environmental threats and opportunities in each strategic area of intervention including their potential impacts on FAA section 117, 118 and 119 issues and climate.

C. Report

- Prepare a report on the status of biodiversity conservation efforts in Angola and implications for USAID or other donor programming that shall define the actions necessary for conservation. This report shall clearly meet the legal requirement of FAA Sec 118 and 119. An illustrative outline for the report is provided below.
- Drawing on the report (even before it is finalized, if necessary), the consultant shall produce the mandatory Environmental Annex required for the USAID/Operational Plan. This annex should be 8-10 pages, and address explicitly the FAA 118-119 concerns in tropical forestry and biodiversity, key threats and opportunities for USAID/Haiti's response, and recommended actions. These will be taken up as appropriate in the USAID/Haiti Strategy and/or operational plan and country assistance strategy.

IX. Outline of Haiti's Country Analysis of Tropical Forests and Biodiversity:

- Title page
- Table of contents
- List of appendices
- List of tables and figures

Executive Summary

A. Introduction: purpose, objective of analysis, and methodology to carry out the analysis.

B. Legislative and institutional structure affecting biodiversity and forestry (terrestrial and marine/coastal ecosystems)

(1.) Government of Haiti (GOH) including institutions responsible for marine and coastal issues
(2.) Non-governmental organizations (NGOs) working in terrestrial and marine/coastal ecosystems
(3.) International organizations working in terrestrial and marine/coastal ecosystems

C. Status and management of biodiversity: protected areas (public and private)

(1.) Description of protected areas (terrestrial and marine)
(2.) Threats and obstacles to sustainable management
(3.) Discussion of on–going activities and efforts
(4.) Gaps

D. Status and management of biodiversity: other managed natural systems

(1.) Description of other managed natural systems (rangeland resources, wetlands, agricultural systems
(2.) Threats and obstacles to sustainable management
(3.) Discussion of on–going activities and efforts
(4.) Gaps

E. Status and management of biodiversity: endangered species and *in situ* wildlife management

(1.) Description of endangered species
(2.) Threats and obstacles to sustainable management
(3.) On–going activities and efforts
(4.) Gaps

F. Status and management of forest resources

(1.) Description of forestry resources
(2.) Threats and obstacles to sustainable management
(3.) On–going activities and efforts
(4.) Gaps

G. Analysis of potential impacts to biodiversity and forest resources of Haiti due to climate change.

H. Recommendations and proposed actions, including review of actions proposed for support by USAID/Haiti (potential best niche)

(1.) Protected areas
(2.) Other managed natural systems including *ex situ* conservation
(3.) Endangered species and *in situ* wildlife management
(4.) Forestry management

I. Appendices

Appendices will include: the SOW for the analysis, biographical sketches of analysis team members, a list of persons contacted and their institutional affiliation, and other background or supporting material as needed, including maps and photographs. Copies

of key document, relevant maps and images, and copies of photographs obtained during the assessment should also be appended in a CD ROM with electronic versions of all written materials. Below is a list of elements, inter alia, that may be included in the appendices

(1.) Bibliography (references cited)
(2.) Biodata sketch of team members
(3.) List of persons contacted
(4.) Other appendices as appropriate
(5) Copy of this scope of work.

V. Details for specific sections of the above outline

Executive Summary: (no more than 4 pages)

- Summarize the two-part legal requirements of FAA 118 and 119,
- Describe the actions necessary to achieve conservation and sustainable management of tropical forests and biodiversity in Haiti,
- Analyze the extent to which the actions proposed for support by USAID/Haiti and other donors meet the needs thus identified.
- Identify gaps in the needs versus proposed activities and recommend how USAID/Haiti's investment can best meet the identified needs and add value to the investments of the Government of Haiti and other donors.

A. Introduction

Provide an overview of the information available and used in the assessment. Identify significant gaps in information on the status and management of tropical forests and biodiversity resources in Haiti.

B. Legislative and institutional structure

Include a review of the current legislative institutional structure for the management of biodiversity and tropical forests. Include a description of major organizations, both public and private, which have a role in this process.

(1.) Government of Haiti

Include a review of the legislative basis, both national and local, for the protection and management of biological resources, including tropical forests. Include a review of international treaties and agreements, which have been ratified by Haiti (CITES, Ramsar, etc.), and the effectiveness of national implementation. Describe GOH's institutions responsible for tropical forests and biodiversity issues, and management of all natural resources. Assess the interest and commitment of the government to the conservation of biodiversity and tropical forests, and summarize whether environmental profiles or national conservation strategies (i.e. obligations per the Convention on Biological Diversity) have been produced or are currently underway.

(2) Non-governmental organizations

Include a description of major organizations, both public and private and both indigenous and international, which have a role in conserving biodiversity and tropical forests and the levels of funding and current programs they contribute toward this issue.

(3) Bilateral, multilateral donors and international organizations

Include a description of other donors and international organizations, both local and international, which have a role in conserving biodiversity (including tropical forests) and the levels of funding they receive and programs they implement or contribute toward this issue. Their relationship with the GOH, membership, and principal programs should be identified. This part of the analysis to avoid duplication of efforts and create synergies.

C. Status and management of biodiversity: protected areas (public and private)

Include an inventory of declared and proposed protected areas (coastal/marine and terrestrial), as well as private protected areas. The GOH agency, NGO or private sector entity managing each protected area should be identified, including all partners in cases of co-management. It should include a country map with the location of all existing and proposed protected areas. Assess the effectiveness of these areas in protecting plant and animal resources, and their importance to Haiti's economy (e.g., for providing tourist opportunities or for protecting important watersheds). An analysis of the management effectiveness (including the degree to which local communities participate in management) in these areas should be included.

Note for narratives addressing (1) threats and obstacles to sustainable management, (2) on–going activities and efforts, and (3) gaps: Assessment to provide a summary of the major threats and issues requiring attention in order to improve the conservation of biodiversity and forest resources. Include the principal threats and impediments to sustainable management of tropical forests and conservation of biodiversity in Haiti. Describe direct threats including, but not limited to, habitat conversion, overexploitation, introduced non-native species, pollution and macro-environmental change and indirect threats and root causes including, but not limited to, demographic change, poverty, insecure land or resource tenure, institutional capacity, economic policies, global market forces, corruption, social and cultural change and climate change. For example, the study should explore issues such as illegal timber harvesting, commercial potential for forest products, regulatory environment, GOH's institutional capacity for regulation and monitoring, fire monitoring and control, etc. On-going conservation efforts should be identified. Present and future requirements for the development of local institutions and training, both government and non-governmental, should be addressed. Issues concerning the management of protected areas should be reviewed. Public participation on biodiversity and forestry conservation should be explored. Special attention should be given to the problems of assuring adequate protection of tropical forests and wetlands (e.g. do existing protected areas encompass most significant biological resources, how are local communities involved in their protection). This section should identify gaps in conservation efforts and prioritize issues needing most immediate attention.

D. Status and management of biodiversity: other managed natural systems outside of protected areas

Include a description of conservation activities within Haiti which are being undertaken outside designated protected areas. This should include, but not be limited to review of:

(1.) Managed natural ecosystems

Include a description of the major Haiti ecosystems and an analysis of their present conservation status. Include country map (to the same scale as the protected area map) of the natural vegetation or habitat types. Text to review the status of managed natural ecosystems, including but not limited to:

- rangeland resources
- wetlands
- agricultural systems

Text to include a discussion of the economic, ecological, and social importance of those ecosystems to Haiti, address their role in the regulation of erosion, management of water flow, and maintenance of productive soils. Place special emphasis on wetlands of Haiti and describe their status and current threats. Address the relationship between land ownership patterns and effective conservation.

(2.) Impacts of development projects

Include a review, by major ecosystem, of the impacts of internationally and locally funded major development projects on tropical forest and biodiversity resources. Review the regulatory framework concerning the implementation of development projects as they affect biodiversity, with emphasis on tropical forests. Specify the environmental review and permitting requirements of the GOH as they concern major projects.

(3.) Ex-situ conservation (eg: zoos, rescue centers, seed banks)

Provide a brief description of *ex situ* species conservation efforts being undertaken and/or planned in Haiti, it should review the programs of natural history museums, herbariums, botanical gardens, zoos, captive breeding programs, and gene banks, including a summary of any existing conservation actions and data-bases. Provide a description of activities being undertaken for the conservation of economically important species and germplasm. Review the status of any rescue centers, gene banks for crop and livestock species, native seed selection, and/or activities being undertaken to support the sustained production of commercially important wild plant and animal species (e.g. for forestry production, agriculture, hunting, fishing or commercial trade), and *in situ* conservation of native varieties of important crops.

E. Status and management of biodiversity: endangered species and *in situ* wildlife management:

Include an inventory of rare and endangered species found in Haiti. Identify their critical habitats and evaluate pressures on these habitats. Review efforts such as species specific management or action plans that have been developed and implemented and assess their effectiveness.

F. Status and management of forest resources:

Include a description of the different types of forests found in-country. An assessment be made of those forests' economic importance, including values for wood, non-timber forest products, tourism, ecosystem services, etc. Existing management structures to be described, including those of the private

forest industry and rural communities. Assess the status of forest certification programs in Haiti, if any, and their impacts on Haiti's forests.

G. Recommendations and proposed actions, including review of actions proposed for support by USAID/Haiti:

Provide a review of proposed actions to address issues concerning biodiversity and tropical forests which may be implemented (indirectly) by USAID, with support from the GOH, international development organizations, and local and international NGOs. Recommendations should be identified with regard to their relative priority and length of implementation period organized by (1.) protected areas, (2.) other managed natural systems including *ex situ* conservation, (3.) endangered species and in situ wildlife management, and (4.) forest management. If available, proposed actions to include a brief description of their objective and anticipated benefits. Include a concise analysis of cost, identification of the appropriate institution(s) for implementation, estimated implementation period, and outline requirements for institutional development and training to assure the sustainability of the proposed program. Describe potential linkages between biodiversity/tropical forest mitigation measures and probable/future USAID/Haiti programs.

Include the identification and assessment of the GOH and NGO institutional and education and training programs to preserve and augment biodiversity and tropical forests, especially where endangered species are apparent. The assessment to address program constraints, including the need to consider conditioning certain assistance upon Haiti's legislative or administrative action in order to officially designate and strengthen the GOH's commitments for protected areas and tropical forest conservation.

H. Recommendations and proposed actions, including review of actions proposed for support by other donors (NGOs, bilateral, multilateral) and host country are doing with their own biodiversity and forest conservation efforts. Similar analysis to "section G".

I. Appendices:

Assessment should include, but not limited to, the following appendices:

(1.) Bibliography
(2.) List of relevant government agencies and NGOs
(3.) Biodata sketch of team members
(4.) List of persons and institutions contacted
(5.) SOW for this analysis.

VI. Duration and Timing of Consultancy

This consultancy is for 23 working days to be in Haiti with the possibility of travel to specific sites – such as protected areas. It is expected to begin August 2nd, 2010. Meetings, phone calls, and preparatory research will take place in July 2010 prior to departure for Haiti. Work in Haiti will take place from August 2, 2010. A six-day in-country work week is authorized for this consultancy. The consultancy will be carried out during the period of o/a August 2nd- September 1st, 2010. About 23 days will be in Haiti, 5-6 days preparation and wrap-up, and 4 days travel. The international consultant will oversee the work of the local-hire consultants. The consultants will work under the technical direction of the USAID/Haiti Program Officer team leader of the analysis team, the REA from USAID/South Africa, Mr. Camilien J.W.

Saint-Cyr (on TDY till August 8th), and the Acting MEO. The regional environmental advisor based at USAID/Dominican Republic and the SEG Team Leader will have an advisory role, to the extent available.

VII. Reporting, Deliverables

Contractor to submit an activity schedule for the subject analysis to USAID/Haiti's Environmental Advisor, Camilien J.W. Saint-Cyr (On TDY through August 8th), the Acting Mission Environmental Officer (MEO) for approval by COB of the second day of the consultancy period. Contractor to produce a complete draft report for review and comments by the Technical Team by COB of day 16. Conduct a debriefing for the Program Office and the SEG Technical Team and other USAID representatives on Day 18. Comments will be incorporated and the consultant will produce a final draft report by COB of Day 20. Contractor to submit the final draft to the Acting MEO and the Program Officer on Day 20 for approval. Acting MEO will have five working days to approve the document or send any final comments or changes to the team leader, and the team leader will have five working days after that to make final changes to meet MEO approval. The full report should have a length of approximately 75 pages.

Deliverables:

- Three hard copies of the document in English, as well as a translation of the Executive Summary
- CDs, to be included with the hard copies.
- Document to include a map of habitat types or biogeographic regions of Haiti.
- Document to include a map of protected areas of Haiti.

At least one stakeholder meeting/workshop during the process to hear concerns/advice and/or socialize draft results/recommendations and ensure main issues were addressed in an adequate manner. Also, a meeting with USAID and appropriate Embassy staff, as appropriate, should be included to gather information for this analysis or share draft results/recommendations.

VIII. Illustrative Schedule

WEEK	**Activity**
Week 1	Submit working schedule for MEO approval on Day 2. Compile and review information.
Week 2	Begin to interview key personnel of key institutions. Continue analysis activities. If necessary, site visits to relevant areas or projects.
Week 3	Continue analysis activities.
Week 4	Submit initial draft by COB Day 16. Debriefing on Day 18. Incorporate comments
Week 5 – 6	MEO to approve document or send any final changes to the team leader before document is approved. Submission of deliverables.

IX. Qualifications of Contractor/Consultants

Assignment requires three senior specialists, one expatriate team leader (natural resource management background) and two Haitians: one with expertise in sustainable tropical forest management and the other in biodiversity conservation; all with extensive experience in, and knowledge of, natural resources in Haiti and/or Latin America and the Caribbean. Team leader to have previous experience in drafting Section 118 / 119 country reports. Consultants should be fluent in French, as most documentation is in French. However, consultants should also have good English language writing skills in order to complete a quality report in the time allowed.

Team Leader:

- Strong applied professional background (M.S. or Ph.D.) in biology, forestry, or closely related field in natural resources management or natural resources economics.
- In-depth knowledge of USAID environmental programs and procedures in Latin America and the Caribbean, ability to lead the country analysis team, preferably with experience drafting Section 118/119 country reports.
- Demonstrated ability in team management.
- Ability to communicate effectively in French and English.
- Solid organizational, analytical, and writing skills in English and French.
- Recognized strong interpersonal skills to relate to a wide variety of stakeholders at all levels.
- Significant experience (10 years) in the design and management of sustainable tropical forest management and natural resource management programs in Latin America and the Caribbean, including:
    - tropical forest management and sociological and anthropological aspects of natural resource management
    - best practices in biodiversity conservation

Local technical support (two people):

- Strong applied professional background (B.S. or M.S.) in biology, forestry, or closely related field in natural resources management or natural resources economics, with 5 years of experience in conservation of biodiversity or protected area management in Haiti.
- Knowledge of USAID environmental programs and procedures,
- Knowledge of USAID strategic planning process related to Tropical Forests and Biodiversity (FAA Sections 118 and 119), and 22 CFR 216.
- Ability to communicate effectively in French and English.
- Solid organizational, analytical, and writing skills in English and French.
- Recognized strong interpersonal skills to relate to a wide variety of stakeholders at all levels.

X- Illustrative Budget (IQC: Direct Contract rates used)

XI. Supporting documentation

Annex 1

Ilustrative list of documents to be reviewed

1. Décret sur le Cadre Institutionnel et les Instruments de Gestion de l'Environnement (October 2005)

2. Low Carbon, High Growth: Latinamerican Responses To Climate Change An Overview (*Augusto de la Torre, Pablo Fajnzylber and John Nash)*

3. Haiti: Mission Order on Environment – April 2010

4. La Réhabilitation de L'Environnement et la Réduction de la Pauvreté – (Haitian Ministry of Environment - June 2007)

5. Environmental Vulnerability in Haiti (Glenn Smucker - April 2007

6. Haiti: Debris Pilot Project (World Bank – May 2007)

7. The Science and Technology of Charcoal Production
   PyNe Subject group report prepared by:
   Morten Gronli , Michael Jerry Antal, Jr. ,Yves Schenkel and Romain Crehay

8. Analyse de la Situation Du GPL au Regard de La Problématique Du Déboisement En Haiti (Michel Carl Simon - Septembre 2009)

9. Growth and Poverty Reduction Strategy Paper (DSNCRP – 2008)

10. On Environmental Brink, Haiti Scrambles for a Lifeline
    by Nathanial Gronewold of Greenwire, November 9, 2009

11. Haiti Regeneration Initiative (Preliminary Concept Note)

12. Measuring Food Insecurity **(**Christopher B. Barrett)

13. Poverty in Haiti (Pal Sletten and Willy Egset: 2004)

14. World Bank Household Energy Strategy
    ESMAP Technical paper – April 2007

15. Environmental Scarcities And Conflict in Haiti (Ecology and Grievances in Haiti's

Troubled Past and Uncertain Future) - by Philip Howard for CIDA - June 1998

Appendix 3. Biodata Sketch of Team Members

Scott Posner, USDA Forest Service, is a Wildlife Biologist and natural resources management specialist with more than 25 years of experience in the field, including four years working in North Africa. He has conducted 118/119 Biodiversity and Tropical Forest assessments for the USAID missions working in the African countries of Tunisia and Togo. In 2009 he was a team member on a USDA Forest Service International Programs/USAID mission to the Democratic Republic of Congo in support of Community Fire Management and Restoration in the Congo Basin.

Gérard-Alain Michel, Independent Consultant, is a specialist in agronomy, Agroforestry, and forest resources. He has more than 10 years professional experience teaching, researching and working with integrated land-use systems in Haiti. As a former Faculty member in Agronomy and Environmental Sciences at Quisqueya University, he taught Applied Ecology and Introduction to Environmental Sciences. He has also studied, researched and worked in the United States and Canada.

Joseph Ronald Toussaint, is an International Consultant, providing services in Africa (Tanzania, Rwanda) and the Caribbean. He has 20 years of experience, including 15 years of supervision, formulation and implementation with government and non-government organizations in environmental management plans, environmental impact assessment, institutional strengthening, monitoring and evaluation. He frequently serves as a representative of the Haitian Ministry of the Environment and he led the National Environmental Action Plan and the formulation of the General Decree on Environment, two major legal and policy instruments that offer guidance on all aspects of environmental management in Haiti. Mr. Toussaint co-authored the 2006 Haiti Country Analysis of Tropical Forestry and Biodiversity