

*(Modified by Odalis Pérez 02/05/02- Typinski's issues addressed)*

## **Annex C: Environmental Analysis – Conserving Biodiversity And Tropical Forest**

### *Environmental History*

Geologically, the Dominican Republic lies in a complex region of platforms and banks, swells and rises, oceanic basins and deep trenches, and of emergent and submerged ridges. It is a region fragmented into countless cayos and islands. Because the region is sandwiched between two massive continental plates (North and South America), it shares with its neighboring islands the occurrence of earthquakes and volcanic eruptions (i.e., Montserrat in July, 2001). The tortured landscape of the Caribbean is the product of this geologic instability. For present day Dominicans, the instability of their geologic past has endowed them with a biologically rich and physically diverse landscape, climate, and soils upon which different cultures have developed.

### *Environmental Context*

Environmental issues in the Dominican Republic are wide-ranging. Watershed degradation, soil erosion, solid and liquid waste disposal and management, water and air pollution, deforestation, biodiversity loss, and pesticide contamination are serious concerns. The matter takes on added importance given the close linkage between the country's natural resource base and its economy. The Dominican Republic has had and will continue to have an economy dependent upon its natural resources. Accordingly, the prospects for economic expansion are inextricably linked to the remediation, protection, and prudent use of the country's natural patrimony. Over the last several decades one of the major constraints to prudent management and protection of the natural resource base has been the absence of government attention to the key environmental issues affecting the Dominican Republic, coupled with the proliferation of dysfunctional public organizations with overlapping responsibilities.

### *Environmental Threats*

Threats to biodiversity in the Dominican Republic include the continuing degradation of forest habitats by land-clearing, human-caused forest fires, and mining. As well, negative environmental impacts are caused by the persistent illegal hunting and capture of certain species for the pet trade (mainly birds and reptiles), and the introduction of exotic species which are particularly pernicious in island environments. Deforestation in a small, lesser developed country is generally not a problem in itself. Deforestation is typically the result of other more difficult problems such as poor regional planning, problems in the distribution of wealth, and the associated problems with lack of access to resources (Crowley, 2001). Deforestation is often associated with the cycle of poverty where the poor are given the blame for changes in the face of the landscape. Although evidence suggests that the expansion of cities (urban in-migration) and changes in the food consumption patterns of Dominicans in Santo Domingo may have a greater impact on the Dominican environment than a single hillside farmer (Crowley, 2001). Local decisions rarely affect entire mountain ranges. Change to the landscape occurs most often

in the decisions made by the affluent and by politicians, as well as the decisions of consumers thousands of miles away.

### *Environmental Loss*

From prehistory to the present time, the leading activities supporting environmental deterioration and loss of biodiversity have been overkill, habitat destruction, introduction of animals such as rats and goats, and diseases carried by exotic animals (Wilson, 1992). In prehistory the paramount agents were overkill and exotic animals. In recent centuries, and to an accelerating degree during our generation, habitat destruction is foremost among the lethal forces, followed by the invasion of exotic animals (Wilson, 1992). To cite an example, in the United States, Canada, and Mexico, 1,033 species of fishes are known to have lived entirely in fresh water within recent historical times. Of these, 27 or 3 percent have become extinct within the past hundred years, and another 256 or 26 percent are liable to extinction (Wilson, 1992). They fall into one or the other of the categories utilized by the International Union for Conservation of Nature and Natural Resources (IUCN), which publishes the *Red Data Books*: Extinct, Endangered, Vulnerable, and Rare. The changes that forced these species of fish into decline are:

Table 1: Causes of Changes in Fish Population

Destruction of physical habitat	73%
Displacement by introduced species	68%
Alteration of habitat by chemical pollutants	38%
Hybridization with other species and subspecies	38%
Over-harvesting (overkill)	15%

[Note: these figures add up to more than 100 percent because more than one agent impinges on many of the fish populations – Wilson, 1992.]

When habitat destruction is defined as both the physical reduction in suitable places to live and the elimination of habitats by chemical pollution, then it is found to be an important factor in over 90 percent of the cases (Wilson, 1992). Through a combination of all these factors, the rate of biodiversity extinction has risen steadily during the past forty years throughout the world.

### *Environmental Knowledge*

The scientific knowledge of biodiversity resources in the Dominican Republic is limited. In 1967, a comprehensive resource assessment was produced by the Organization of American States, and in 1978 an assessment was conducted by Michigan State University on the status of Dominican forests. The data sets from those two sources have outlived their relevance if not supported by current research and data. Many local researchers in the Dominican Republic exclude data or citations, which further exacerbates the credibility and relevance issue. The best source of material is the Country Environmental Profile, which was produced by USAID in 1981. USAID completed an updated Dominican Republic Environmental Assessment in September 2001. This assessment, conducted under the Environmental Policy and Institutional Strengthening Indefinite Quantity Contract, was based on available secondary data and provides

valuable information on the state of the environment and the most critical issues affecting the environment in the Dominican Republic. The findings of the assessment have been incorporated in this Annex. In addition, the Dominican Government published a national forest inventory in June 2001 through the Secretariat of Environment and Natural Resources. The findings of this inventory have been incorporated in pertinent sections below. These new sources of information provide a clearer picture on the status of biodiversity in the Dominican Republic. Improved knowledge of the conservation status and ecology of many little known species will improve the ability to conserve them. This will require an investment in education and research.

### *Environmental Policy*

As a result of USAID supported policy dialogue and technical assistance to the Dominican Republic over the last decade, the environmental legal framework underwent major change in 2000. The approval by the National Congress of Law 64-2000 (dated August 18, 2000) created a new legal and institutional framework. It created the Secretariat of Environment and Natural Resources, and integrated into the Secretariat other public institutions with environmental functions. This act of incorporation created, for the first time, the vision of integrated environmental management. The key difference between the resource management of the past and the ecosystem management of today is that the former was a more individualized approach, while the latter is a more integrated approach. Within this new legal and institutional framework, more elements will be considered in the decisions made, and the decisions will be considered at a broader range of spatial and temporal scales.

Law 64-2000 also established a series of environmental policy principles for the Dominican Republic, to which the private sector and current and successive governments presumably must adopt. Law 64-2000 not only reorganized the legal policy and public institutional framework, it also established the underlying instruments through which policy may be executed. Law 64-2000 also formed the basis for empowering individual Dominicans, communities, NGOs, the private sector, and others to participate more fully in environmental dialogue and in the planning and execution of environmental initiatives. Several principles incorporated by the law reflect efforts to link environmental policy with economic development. Protection of biodiversity is one of the major underlying principles incorporated by Law 64-2000.

### *Relationship's Between Flora, Fauna (terrestrial/aquatic) and Habitat*

Every living organism has limits to the environmental conditions it can endure. Temperatures, moisture levels, nutrient supply, soil and water chemistry, living space and other environmental factors must be within appropriate levels for life to persist. After many years of research, it is known (Cunningham and Saigo, 1997) that the interaction of several factors working together, rather than a single limiting factor, determines biogeographical distribution. Some organisms may have a specific critical or limiting factor that, more than any other, determines the abundance and distribution of that species in a given living space. The principle of tolerance limits states that for every environmental factor, an organism has both maximum and minimum levels beyond which it cannot survive. The greatest abundance of any species along an environmental gradient is around the optimum level of the critical factor most important for that species. Near the tolerance limits abundance decreases because fewer individuals are able to survive the stresses imposed by limiting factors (Cunningham and Saigo, 1997).

### *State of the Dominican Republic's Fauna and Flora*

The fauna and flora of Hispaniola varies drastically across the landscape. It is an island where roughly one-third of the biological species can be found nowhere else in the world. All accounts of Hispaniolan biodiversity are incomplete (Crowley, 2001). Often, this is due to the lack of communication and cooperation between Dominican and Haitian institutions, and the lack of adequate funding for biologists on both sides of the border. Almost all of the information reported in the Dominican Biodiversity Study published in 1990 was based on old (and sometimes statistically impure) information. For that reason, many of the estimates presented herein should be considered Dominican rather than Hispaniolan.

In the decade that has lapsed since its publication (1990), many rare or vulnerable species may have already succumbed to the trend of rampant habitat destruction. Many of those species may now be confined to small enclaves of deep troughs on remote hillsides, saved only by their inaccessibility. On the positive side, there is still a wealth of biodiversity yet to be discovered. Studies of fungi, lichens, and vascular plants, (especially the grasses) is woefully incomplete and in need of identification and documentation (Crowley, personal communication with R.Garcia). Many of the endemic plants and animals are present in limited numbers or in very restricted ranges. Unfortunately, specific ranges for all species are not known with a high degree of certainty because of a lack of available data. All scientists agree that the Dominican endemic flora and fauna are probably either rare or threatened with habitat destruction, pressure from exotic species, or declining gene pools.

### *Floral and Faunal Diversity and Endemism*

The Dominican Republic has an exceptionally high rate of endemism. Island habitat endemism is particularly fragile and subject to extinction. Accordingly, aggressive conservation is required to preserve the country's rich biodiversity. The fact that neighboring Haiti has little native terrestrial habitat left gives added importance to conserving the Dominican Republic's biological uniqueness. Table 2 identifies the variety and rate of endemism of native species. Almost all the reptiles and amphibians are endemic, and more than a third of the Dominican Republic's flora is endemic.

**Table 2: Species-Level Biodiversity in the Dominican Republic**

	Number of species	Number of endemic species	Percentage of species that are endemic
<b>Flora</b>			
Vascular plants	5,600	1,800	32
Algae	168	unknown	Unknown
<b>Fauna</b>			
Mammals	48	2	10
Birds	296	26	9
Reptiles	146	138	94.5
Amphibians	65	63	97
Fishes	399	–	–
Molluses	311	–	–
Arthropodes/Crustaceous	164	–	–
Cnidarious	111	–	–
Echinodermata	67	–	–
Polipherous	39	–	–
Annelidous	6	–	–

Sources: CIBIMA 1994, SEA/DVS 1990, UNDP 2000, CEPNET IDB, Liogier 1978, CIBIMA 1994.

### *Species Threatened and at Risk of Extinction*

The biodiversity of the Dominican Republic faces numerous threats, especially due to the loss of a major portion of the terrestrial forest habitat. At least 10% of the species in the Dominican Republic and 33% of the vertebrates (mammals, birds, reptiles, amphibians, and fish) are endangered or threatened with extinction (table 3). By any standard, this is an extremely high rate of potential loss of biodiversity.

**Table 3: Threatened Species in Dominican Republic**

Species group	Total species	Percentage of total species in this class	Number of species threatened or endangered	Percentage of class or group threatened with extinction
Plants	5,600	75.4	442	8
Algae	168	2.3	Unknown	–
Vertebrates	954	12.8	204	33
Invertebrates	698	9.4	117	17
<b>Total</b>	<b>7, 420</b>	<b>100</b>	<b>763</b>	<b>10</b>

Source: N. Ramirez 2001.

Marine species, including a diverse array of marine mammals (whales, dolphins), are poorly known and not well represented in this analysis. Although marine species are mobile and not as often endemic it is noteworthy that the near-shore banks of the Dominican Republic are the most important wintering area for humpback whales in the Atlantic Ocean.

*Dominican Vertebrate Fauna (terrestrial & aquatic)*

The Dominican vertebrate fauna is divided into five groups: freshwater fishes, amphibians, reptiles, birds, and mammals. As with the flora, the vertebrate fauna demonstrate an impressive level of species diversification. Table 4 provides a summary of overall species diversity:

Table 4: Vertebrate species diversity in the DR (SEA, DVS, 1991)

Group	Orders	Families	Genera	Species	Subspecies
Fishes	-	21	41	70	70
Amphibians	1	4	7	60	75
Reptiles	4	15	34	141	327
Birds	20	53	151	254	268
Mammals	6	17	29	33	34
Totals	31	110	262	558	774

The number of subspecies per family provides a clue as to the diversity within a given class of vertebrate. Although birds demonstrate the highest number of species across all vertebrate groups, the amphibians and the reptiles show the highest degree of species diversity.

*Endemism among the Vertebrate Groups (terrestrial & aquatic)*

The categories for the status of classes of vertebrates are described in table 5: endemic, native, introduced and migratory. In addition, a separate category known as “colonizers” is also used with bird species, but is not considered in this summary.

Table 5: Endemism among vertebrates in the DR

Group (# species)	Endemic (%)	Native (%)	Introduced (%)	Migratory (%)
Fishes (70)	31.2	36	32.8	-
Amphibian(60)	96.7	0	3.3	-
Reptiles (141)	83.0	15.6	1.4	-
Birds (254)	8.7	40.9	3.9	46.4
Mammals (33)	12.0	51.5	36.3	-

Fishes – There is roughly a thirty percent endemism rate for fishes. Endemic fish species are threatened by changes in water quality due to soil erosion/siltation, solid wastes from urban areas, and agricultural runoff. The latter two often result in nitrate saturation and algae blooms, which rob fish of oxygen. Two new fish species were recently discovered, one in freshwater swamps near tourist areas in the eastern DR (around Bavaro) and the second in hot sulfur springs where many Dominican tourists regularly go to bathe.

Amphibians – The only two introduced species to this taxa have had a disproportionately high impact on the Dominican ecosystem. One large bullfrog (*Bufo marinus*) and a toad (*Ranus*

catsbeiana) were introduced for pest control in the sugar cane fields and for food consumption in the 1930's and 1950's. As insectivores, their impact on the native invertebrate populations and their displacement of other amphibians in the ecological web is unknown. In terms of distribution of amphibians in the DR, about thirty percent are considered to be widely distributed, while seventy percent are found in very restricted ranges.

Reptiles – Among the twenty species with a low tolerance to disturbance are four species of marine turtles, three species of lizards, two species of snakes, and the crocodile. In terms of abundance, eighty percent are labeled as either very common or common. At least 13 species are rated as rare to very rare and are probably threatened. Predation on reptile eggs by dogs and cats is a significant factor impacting negatively on a species. As well, local poaching of eggs and meat for medicinal and cultural purposes are elements contributing to the demise of the reptile group.

Birds – Many more species of birds may be colonizing the Dominican Republic than is currently thought. Bird data is being generated by the seasonal visitors/birders flocking to the DR. Over the last two years, at least seven first sightings and many more second and third sightings have been reported. Since birds are very mobile, they generally do not have a high endemism rate. Over forty percent of the resident bird species are considered threatened and of that number, over half are endemic species or subspecies. Habitat loss is the single most influential factor that contributes to avian decline.

Mammals – The endemic mammals are the most threatened by habitat destruction and by introduced species predation. Presently, seven species are considered threatened: two solenodon species, two plagiodontia species, two native bats and the Manatee.

#### *Dominican Invertebrate Fauna (terrestrial & aquatic)*

There appears to be no systematic documentation of the invertebrate fauna at any level of classification in the Dominican Republic. Significant work has been done on the Lepidoptera family and there exists general insect collections at several Dominican universities, but there has been no coordinated attempt to analyze the status of DR terrestrial and aquatic invertebrates.

The 1988 Biological Diversity Assessment Report for the Dominican Republic (1988) observed there were numerous problems impeding efforts to conserve the country's biological resources. These problems still exist today, and as they were in 1988, can be divided into three groupings depending on their causes. Some stem from the GODR policies and priorities, its organizational structure and budget priorities. Others result from unrestricted and unplanned development for agriculture and tourism. Finally, certain social and cultural biases exist which hinder efforts to protect and conserve the country's biological resources.

#### *Coastal Marine Biodiversity*

During the last decade of the twentieth century, coral began bleaching and dying across regions of the world in association with changes in ocean and climate conditions. As well, coral reefs are being degraded and destroyed worldwide due to a variety of direct human activities. Examples of these activities are: growing coastal populations, shoreline and inland development, pollution from sewage, fertilizers, chemicals, and sediment runoff, overfishing and overuse,



destructive fishing practices including poisons and explosives, and ship groundings and anchor damage.

Coral reefs are a valuable asset to not only the healthy functioning of our global ecosystem, but as well make healthy contributions to our global society. Covering less than one percent of the planet's surface, coral reefs and their associated mangrove, seagrass, and other habitats are the world's most biologically diverse marine ecosystems. Coral reefs are valuable assets to local and national economies. They support fisheries and are sources for other foods, materials for new medicines, and income and jobs from tourism and recreation. As well, they provide an extra bonus in the form of protecting coastal communities from pounding storms.

### *Dominican Republic Coral Reefs*

The major physical factors affecting coral reef development include freshwater runoff from the land, routine wave exposure (especially from the north-east and open to the Atlantic), and sea temperatures, which may be modified by cool upwellings from adjacent deep water or by the warm Gulf Stream. The central/eastern part of the DR is mountainous, where large rivers drain extensive watersheds. Unfortunately, reef growth is limited here since the freshwater is mixed with sediments due to erosion. Only 27% of the 1,400 km shore is fringed by mangroves and only 12% by coral reefs (Wilkinson, 2000). Important reef areas on the north shoreline (Atlantic coast) include the Montecristi barrier reef in the north-west, narrow high-energy reefs in the central region and the Bávaro-El Macao-Punta Cana barrier reef system at the eastern end. Samaná Bay receives many rivers and is the largest estuary of the insular Caribbean. Coral reefs in the greater Samaná area are poorly developed (Wilkinson, 2000). The southern shoreline in the DR (Caribbean coast) has been more extensively studied in the Parque Nacional del Este and the adjacent Isla Saona areas. Conditions in the southwest are not good for coral reef development, except on the shallow sheltered shelf east of Cabo Beata at Parque Nacional Jaragua.

Increasing human population and economic development underlie much of the stress on coastal ecosystems, through sedimentation, sewage and other terrestrial pollution from agriculture, mining, industry, shipping and tourism (Wilkinson, 2000). Coastal habitats have been destroyed for tourism, not only in construction, but misguided reconditioning of beaches causing more sediment damage. As well, over-fishing of coral reef resources is still a problem.

### *Key Issues in Biodiversity Conservation*

- Threats to biodiversity in the Dominican Republic include the continuing degradation of forest habitats by land-clearing, human-caused forest fires, and mining; the illegal hunting and capture of certain species for the pet trade (birds, reptiles); and the introduction of alien species that are particularly pernicious in island environments.
- The scientific knowledge of biodiversity in the Dominican Republic is quite incomplete. Improved knowledge of the conservation status and ecology of many little-known species will improve the ability to conserve them. This requires an investment in education and research.
- Many terrestrial species probably owe their continued existence to the substantial national park and protected area system being developed in the Dominican Republic.

*Protected Areas in the Dominican Republic*

Over the past two decades, the Dominican Republic has dramatically expanded its protected area network. In 1980 there were only 9 protected areas. By 2000 that number had grown to 70 (table 6). The part of the protected area network that is completely land based accounts for 16% of the country's total area. In addition, there are parts of protected areas (Jaragua, Del Este, Los Haitises and Montecristi) that are marine niches, while there are other parks (Banco de la Plata Marine Sanctuary) that are complete marine environments. The marine parks and the aquatic parts of the predominantly land reserves add over 27,000 km<sup>2</sup> to the protected area network (table 7). This significant expansion reflects a conscious effort on the part of government, and the growing interest of the public, in protecting the country's natural resources. It also reflects the increasing emphasis on biological and natural science education, and the political influence of the conservation stakeholders.

The protected area system in the Dominican Republic is rapidly improving, but obviously still quite deficient in management infrastructure, staff, and visitor infrastructure. Political will must be generated to adequately fund the government entities responsible for patrolling and managing 16% of the Dominican land surface. A number of NGOs are assisting in the task of managing the national parks in the Dominican Republic, using several co-management models. Much work remains to be done in the area of strengthening relationships with local organizations, including not only NGOs, but also communities and municipalities.

**Table 6: The Increase in Protected Areas by Decade**

Protected areas	To 1980	1981–90	1991–2000
Scientific reserves	1	6	10
National parks	8	12	22
National monuments			9
Anthropology reserves			2
Fauna refuge			7
Fauna sanctuary		1	
Wildlife refuge		1	
Panoramic view		1	10
Ecological corridors			6
Recreation areas			3
Special ecological reserves			1
<b>Total</b>	<b>9</b>	<b>21</b>	<b>70</b>
<b>Percentage of national land surface included</b>	<b>4.2</b>	<b>11.2</b>	<b>16</b>

*Sources:* Mores 1980, Valdés and Mateo 1992, Ramirez 2001, IRG 2001.

**Table 7: Size and Status of Protected Areas by Category**

UICN category	Number of areas	Total area (km <sup>2</sup> )	Surface area (km <sup>2</sup> )		Management plans	Areas with visitor infrastructure	Areas with management infrastructure	Area with staff
			Terrestrial	Marine				
Scientific Reserves	10	639	546	94	2	2	2	2
National Parks	22	8,485	6,359	2,126	8	6	14	17
National Monuments	11	246	155	98	–	–	3	5
Wildlife Refuges	7	25,577	273	25,303	–	–	2	2
Other	20	546	513	33	–	–	–	0
<b>Total</b>	<b>70</b>	<b>35,494</b>	<b>7,844</b>	<b>27,646</b>	<b>10</b>	<b>8</b>	<b>–</b>	<b>26</b>
Percentage			16%	12%				

Sources: UNDP 2000, Sub-secretariat of Protected Areas and Biodiversity (consultant) Bonnelly de C. 1996, Bibliography for *Management and Development of the Marine Protected Areas in the Dominican Republic.*, IRG 2001.

### *Marine Protected Areas in the Dominican Republic*

There are six Marine Protected Areas, which cover the largest reef tracts and the most important nursery areas. Currently, they have no protection and no management, and there is intense fishing within them – they are as follows:

- Parque Nacional Montecristi – the largest, least impacted coastal park, with diverse ecosystems;
- Humpback Whale Sanctuary – including the Silver and Navidad banks;
- Parque Nacional Los Haitises – in Samaná Bay, dominated by mangroves and estuaries;
- Parque Nacional del Este – this is the most studied Marine Protected Area, and is an important nursery for conch and lobster;
- Parque Nacional Submarino La Caleta – oldest Marine Protected Area, and is an important eco-tourism dive site; and
- Parque Nacional Jaragua – also an important lobster nursery.

Recently (Wilkinson, 2000), the coral reefs in most of these areas were assessed by the Centro de Investigaciones de Biología Marina, Universidad Autónoma de Santo Domingo, Fundación MAMMA, Inc. (local NGO) and the National Aquarium. It is the opinion of the Global Coral Reef Monitoring Network (GCRMN) the Dirección Nacional de Parques lacks qualified people to manage the Marine Protected Areas and the Fisheries Department lacks enforcement officers and an effective extension program. As well, there are no appropriate penalties for violation of existing laws and there exists confusion as to which institution should apply them (Wilkinson, 2000). The approval by

the National Congress of Law 64-2000 (August, 2000) is coupled with environmental legislation that consists of over 300 environmental decrees, regulations and orders, administered by a large number of organizations. The newly formed Subsecretaría de Gestión Ambiental and the Subsecretaría de Recursos Costero Marinos (both under the Secretaría de Medio Ambiente y Recursos Naturales) are challenged with managing the Marine Protected Areas where there exists considerable overlap of authority among institutions dealing with coastal issues and a lack of any central long-term vision on sustainable coastal area management and biodiversity conservation.

### *Endangered Species in the Dominican Republic*

At present, it is unclear as to whether any of the threatened or endangered species listed in the 1988 Biological Diversity Assessment or the 1993 Tropical Forestry and Biological Diversity Assessment for the Dominican Republic appear to have improved in status. Today, as in the past, conservation efforts are not commonly directed towards single species conservation. As well, both assessments support the fact little is known of the status of endangered plant species in the Dominican Republic (Rieger and Powell, 1993). Rieger and Powell (1993) make reference to a draft version of a biodiversity strategy developed by the World Wildlife Fund (1992) which listed the following animal species as in particular danger of extinction in the Dominican Republic. The associated numbers indicate the rank order of peril.

Rank order of peril	Scientific name	Common name
1	<i>Crocodylus acutus</i>	American crocodile
1	<i>Alsophis melanichnus</i>	Culebra corredora
1	<i>Solenodon paradoxus</i>	Solenodon
1	<i>Solenodon marcanoi</i>	Solenodon
1	<i>Plagiodontia aedium</i>	Hutia
1	<i>Mycteria americana</i>	Pheasant or coco
2	<i>Trichechus m. manatus</i>	Antillean Manatee
2	<i>Pterodroma hasitata</i>	Diablotin
2	<i>Asio stygius noctipetens</i>	Sabana owl
2	<i>Loxia leucoptera megaplaga</i>	Pico cruzado
2	<i>Alsophis anomalus</i>	Culebra corredora
2	<i>Eretmochelys imbricata</i>	Green turtle
2	<i>Demochelys coriacea</i>	Leatherback turtle
2	<i>Chelonia mydas</i>	Sea turtle
2	<i>Caretta caretta</i>	Caguamo
3	<i>Cyclura ricordi</i>	Richard iguana
3	<i>Trachemys decrata</i>	Jicotea decorada
4	<i>Cyprinodon higuey</i>	Titaco de Higuey
4	<i>Limia sulphurophila</i>	Limia de agua azufrada
5	<i>Cyclura cornuata</i>	Rhinoceros iguana
5	<i>Trachemys stejnegeri vicina</i>	Jicotea comun

5	<i>Phoenicopterus ruber</i>	Flamingo
6	<i>Aratinga chloroptera</i>	Parakeet
7	<i>Amazona ventralis</i>	Cockatoo

### Key Issues in Protected Area Management

According to IRG (2001) some of the most prominent issues affecting protected areas in the Dominican Republic are:

- *Budget and Financial Management*—The dramatic expansion in number and size of national protected areas has not been accompanied by a corresponding budget. Of particular concern is the possibility that private property included in new parks might be subject to financial compensation.
- *Physical Demarcation and Patrol*—Many of the protected areas have no physical demarcation of boundaries, signs designating their borders, or staff to patrol and educate local communities about the parks.
- *Development of Tourism Facilities*—Absence of appropriate infrastructure for tourist use hampers the access to many parks. In some cases, private investors are interested in helping develop park infrastructure, especially coastal areas, but this issue is a two-edged sword, and potentially controversial.
- *Invasion of Protected Area Lands by Agricultural and Recreational Users*—Some remote parks suffer from agricultural invasions, a continuing problem in Parque Nacional los Haitises. In Dunas de las Calderas mangrove and dune areas are being eliminated for construction of private recreational residences.
- *Natural Resource Damages*—Deforestation, poaching (for meat or pet trade), off-road vehicles (on dunes/beaches especially), and forest fires are all serious problems in some protected areas.
- Community relations, participation in management, and compensation to local communities who have lost some traditional uses of protected areas are all major issues for the national park service.
- There is a need to carry out economic valuations of protected areas in order to provide environmental and economic bases for investment.

#### *Dominican Republic Government and External Donors – Conserving Biodiversity*

There is an effort to cooperate in the future on national priorities as it relates to terrestrial and marine biodiversity protection between the Secretariat of Environment and Natural Resources and external donors (GODR, 2001). The cooperation will focus on the sustainable management of forest and coastal resources, where natural resource management norms developed by the GODR will be followed. Dominican society will receive environmental education that emphasizes biodiversity conservation and preservation. Citizens will be engaged not only in the classroom but as well in the field at locations that are ecologically vulnerable to biodiversity loss. Collaborating organizations specifically addressing biodiversity conservation are: U.S. Agency for

International Development (USAID), The Nature Conservancy (TNC), World Bank (WB), United Nations Development Program (UNDP), German Technical Cooperation (DED, GTZ), and the Spanish Agency for International Cooperation (AECI).

*USAID/Dominican Republic Contributions to Conserving Biodiversity*

To help the Dominican Republic address its most pressing environmental issues, including protection of biodiversity and sound management of the protected area system, the Mission has planned a series of key interventions under the Improved Policies for Environmental Protection and Risk Management Intermediate Results. Activities will improve the institutional capability for environmental protection at the Secretariat of Environment and Natural Resources and selected municipalities; increase civil society involvement in environmental protection and risk management; and reduce disaster vulnerability in selected municipalities/communities. The Mission seeks support to continue expansion of the Parks in Peril program to increase emphasis on conservation science, long-term financing, and the development of local communities oriented to conservation of the country's parks through public/private partnerships.

*USAID/Dominican Republic Biodiversity Conservation in Action*

USAID Global believes the future well-being of all humanity depends on our stewardship of the Earth. The extinction of each species brings the irreversible loss of unique genetic codes, which are linked to the development of medicines, foods, and economic opportunities. The response of USAID to biodiversity conservation in developing countries is to maintain biologically diverse habitats and environmental services while supporting economic growth. This will be accomplished by applying a threats-based conservation philosophy. It is through the use of this approach USAID/DR will be able directly link interventions and the threats to the conservation of biodiversity. The following three steps outline the approach:

- 1) Direct threats to biodiversity are identified and prioritized in a site-specific context.
- 2) Conservation activities are developed based on this prioritized list of threats.
- 3) Adaptive management techniques are applied to monitor new and existing threats and respond appropriately and effectively.

The primary assumption of threats-based conservation is that it is the most effective way to conserve biodiversity, as well as the most efficient use of time and money in combating the factors causing biodiversity decline. The USAID/DR Mission will address direct threats to biodiversity loss in a site-specific context using the threats-based philosophy. USAID/DR will seek out stakeholders and leverage partnerships to maximize their efforts to address, halt and reverse the threats to biodiversity in the Dominican Republic. The Mission will continue support to the Parks-in-Peril Program and will contribute matching funds to incorporate a new park under PiP 2000 in FY2002.

# Tropical Forest Resources of the Dominican Republic

## *Dominican Flora (terrestrial)*

The Dominican flora is very unique and very Antillean. There are 201 plant families described for the island (Liogier, 2000). Among those families, 1,281 genera are divided into 5,600 species. Of these species, over 1,800 are found only on Hispaniola, which implies a rate of endemism of roughly thirty-six percent. To illustrate the high rate of endemism in the Antillean flora, Crowley (2001) developed table 8 from Liogier (2000):

Table 8: Greater Antillean floral endemism

Island	Area (km <sup>2</sup> )	Genera	Endemic Genera (%)	Species	Endemic Species	Endemic Species (%)
Cuba	114,914	1,308	62	5,900	2,700	45.7
Hispaniol	77,914	1,281	35	5,600	1,800	32
Jamaica	10,991	1,150	4	3,247	735	22.6
Puerto Rico	8,897	1,256	2	3,034	228	7.5

After the endemic species, the most common link of shared flora is with Cuba, followed by Jamaica and Puerto Rico. There is a small percentage of South and Central American species overlap. As a result of the uniqueness of the upper Antillean fauna, biogeographers believe Cuba and Hispaniola were centers of biodiversity from where species traveled to other parts of the Antilles.

The Dominican Republic has a wide variety of forest cover. Broad-leaf forests, including high-elevation cloud forests, as well as humid forests, and semi-humid forests, are widespread in the steeper and less accessible areas of the northern, central, and eastern parts of the country. Conifer forests, made up almost entirely of the indigenous *Pinus occidentalis*, are found at very high elevations, principally in the Cordillera Central. Dry forests are widespread in the south, southwest, and eastern tips of the country. Many of the best remaining forest stands are in protected areas (Secretariat of Environment and Natural Resources, 2001).

Before 1980, forests that once covered 70% of the country were drastically reduced by logging and agricultural invasion. Between 1980 and 1998, several studies were carried out to measure forest cover. The fact that these studies used different methodologies makes it difficult to compare, in quantitative terms, the status of forested land area. What can be concluded from the CRIES (1980) and DIRENA (1998) studies is that the total area under forest cover increased by about 550 square kilometers in the intervening 18 years (table 9). Furthermore, it appears that coniferous forests have recovered the most, the DIRENA study indicates that land area under broad-leaf dry forests has expanded significantly. But, again, the differences in definitions in forest categories between the two studies make it impossible to draw a definitive conclusion. However, at least the data

indicate that broad-leaf forests have more or less stabilized in the past 20 years compared to the trend in the period before the 1981 Country Environmental Profile. The country's land area with forest vegetation for 1980 and 1998 is presented below.

Table 9: Land Area with Forest Vegetation as Quantified by Various Studies (km<sup>2</sup>)

Type of land use or cover		CRIES 1980	DIRENA 1998
Broad-leaf forest	Humid	6,518	6,306
	Dried, mixed, and others		3,889
Coniferous		311	3,025
Sugarcane		4,025	3,682
Tree crops (coffee, cacao, etc.)			3,414
Intensive pastures		2,325	2,636
Others: marginal agriculture, pastures, matorral, tree crops, other forests		27,417	17,595
Urban areas		292	394
Arid, eroded, bare land		402	1,306
Total		47,657	48,224

*Source: CRIES 1980, DIRENA 1998, IRG 2001.*

A forest inventory conducted by the Secretariat of Environment and Natural Resources in 2001 determined that the total forest cover of the Dominican Republic (coniferous, broad-leaf, and dry forest) is 13,266 km<sup>2</sup>. This is roughly the same area as per the 1998 DIRENA and 2001 IRG reports (table 9) and represents 27.5% of the total country surface. Calculation of deforestation rates in the Dominican Republic has been a matter of open discussion, given the differences in methodologies for estimating forest cover as discussed above. Whereas in 1992 TRD estimated an overall 2% annual deforestation rate through 1990, a recent FAO report (State of the World's Forest, 2001) lists the 1990-2000 deforestation rate as 0% for the Dominican Republic. The Secretariat of Environment and Natural Resources has initiated the preparation of land use/land cover maps to more accurately determine forest cover and deforestation rates as a base for planning targeted interventions to address the most pressing forest issues in the Dominican Republic. This work started with USAID technical assistance under the Hurricane Georges Reconstruction Program in 2001 in collaboration with the United States Geological Survey (USGS). The Secretariat of Environment and Natural Resources is seeking additional funding to complete the map in 2002.

As per IRG, 2001 forest cover has stabilized and is in an incipient recovery status. The reasons for the stabilization and incipient recovery of forests include:



- Economic policies that (1) reduced taxes on the importation of low cost food commodities which, in turn, contributed to a reduction in steep slope subsistence agriculture, and (2) subsidized bottled cooking gas which, in turn, had a direct impact on the dramatic reduction of the charcoal-making industry.
- The growth of the urban-based industrial (e.g., free zone manufacturing) and service (banking and tourism) sectors that helped fuel a migration of rural residents, especially hillside agriculturalists, to the cities.
- Government-sponsored reforestation and natural resource management programs.
- Natural regeneration of former agricultural hillside land.
- Expansion in the number and size of protected areas.

#### *Forest Management Initiatives*

In 1988 the National Forestry Technical Commission (CONATEF) emitted Resolution 3-88 that started a Program of Certification of Plantations with Rights to Harvest (IRG, 2001). This program has contributed to a number of private forest plantation efforts by establishing the legal right “to use trees planted on one’s own land.” Between 1988 and 2000, this program issued almost 6,000 certificates resulting in more than 16,000 hectares planted in forest. Furthermore, the program has been gaining momentum steadily. In 1991 only 400 hectares were planted under the program. In 2000 the area planted was more than 2,000 hectares. Several notable forest management activities have been initiated in the past 20 years. Plan Sierra’s La Celestina Project and the Zambrana Agroforestry Project are among the most successful forest management activities in country.

#### *Government Reforestation Efforts*

Since 1981, the national government has launched a series of large-scale reforestation campaigns. Most notable among these efforts is the Quisqueya Verde initiative that began in 1997. Quisqueya Verde was an ambitious undertaking that set as a goal the planting of 30 million trees in three years. Despite a heralded launch, the project’s success is debatable. It has suffered from the difficulties similar to those experienced by other reforestation efforts in the Dominican Republic. To illustrate, government land available for reforestation has not been clearly identified, private landowners fear that land reforested will be lost to productive uses, and commercial operators fear that, given current policy, they will be prohibited from harvesting their trees (IRG, 2001). The Secretariat of Environment and Natural Resources is in the process of launching a national reforestation program which will start in the Artibonito river watershed and will initially be financed with government resources.

### **Forest Protection Issues**

#### *Charcoal-Making*

In 1981, when the Country Environmental Profile was published by USAID, charcoal production for urban cooking fuel was a large rural industry that impacted dry woodlands and forests in the Dominican Republic. In 1985 the consumption of wood for charcoal,

used for cooking by nearly two-thirds of the entire population, was estimated at 4,172,700 m<sup>3</sup> of wood per year (Gomez 2001). Beginning in the mid-1980s a government policy of subsidizing propane gas and cooking stoves, suggested by the National Commission for Energy Policy (COENER), was set in place. While perhaps a distortion to the economy at large, this policy presumably boosted forest protection efforts. According to the General Directorate of Forestry (DGF), now a dependency of the Secretariat of Environment and Natural Resources, charcoal consumption dropped from 1,596,000 sacks in 1982 to 26,465 sacks in 2000 (Gomez 2001).

The decline in the charcoal-making industry has had a significant impact on the rural economy. Many poor households lost an important source of income. However, while quantifiable data are not available, it is believed that this loss was offset by the movement of farmers to urban jobs, especially in the free zone light-manufacturing sector.

### *Forest Fires*

As a matter of course, significant numbers of forest fires break out in the dry season in Dominican Republic. The Secretariat of Environment and Natural Resources has tabulated information on forest fires and reports that during 1981–2000 there were 1,365 recorded forest fires affecting 72,796 hectares. The years 1990 and 1997 were particularly bad fire years, with 15,269 hectares and 13,075 hectares respectively burned. Commonly, 1,000–5,000 hectares are affected annually. The Secretariat of Environment and Natural Resources has trained fire-fighting brigades and provided some specialized equipment and training.

### *Importing Forest Products*

The Dominican Republic continues to be a net importer of wood products, as well as paper. Data on wood product imports alone indicates that the country spent an average of US\$50 million a year of foreign exchange on sawn wood, both pine and fine hardwoods. And 85%–90% of imported wood volume is made up of American and Chilean pine (Gomez 2001). In 1981, the Country Environmental Profile indicated that the Dominican Republic was importing US\$30 million a year of wood products.

### **Key Issues in Forestry**

- *Absence of an Industrial Forestry Sector*—The forestry sector has stagnated in the Dominican Republic as a result of government policies to restrict wood harvest. No viable commercial timber industry exists. Most legal forest plantations are young and of small size (less than 5 hectares). It is unclear whether standing timber would be available to support a viable industry.
- *Negative Incentives for Private Land Forestry*—Despite the limited success of the Certification of Plantations Program, few private landowners in the Dominican Republic are planting tree crops owing to negative incentives for reforestation.

- *Silvicultural and Forest Management Models*—Little research is being done on forest management, and most attention has been given to exotic species (*Cassia mangium* and *Pinus caribea*) or the indigenous pine. Numerous native broad-leaf hardwoods exist (including local species of mahogany *Sweitenia*), and it is likely that much reforestation could be rapidly accomplished by natural regeneration if the right incentives were there.
- *Future Uses of Public Lands and Sugar Council Lands*— It is important to look at what role national government land, and land now controlled by the State Sugar Council (CEA), could be available for use in large-scale reforestation, perennial crop production, or other uses. It is imperative that the new uses on any large-scale government tracts be based on sound research, including silvicultural studies and market research.
- *Forest Cover Stability*—The loss of forest cover appears to be stabilizing; there is some suggestion of forest recovery.

#### *Initiatives to Address Forestry Issues*

Under the *Increased Economic Opportunities for the Poor* Strategic Objective, USAID will provide technical assistance to strengthen the Secretariat of Environment and natural Resources and enhance the Secretariat's capability to address some of these issues. The full range of issues and activities to focus USAID assistance is in the process of definition with the Secretariat of Environment and Natural Resources and other donors. The drafting of a Forestry Law and its implementing regulations, as mandated by Environment Law 64-2000, and targeted TA to improve the existing forestry permitting system are areas of immediate USAID assistance to help address the forestry issues above.

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