CRITICAL ECOSYSTEM PARTNERSHIP FUND

Ecosystem Profile

THE CARIBBEAN ISLANDS BIODIVERSITY HOTSPOT

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Prepared by:

BirdLife International

in collaboration with:

Durrell Wildlife Conservation Trust / Bath University
The New York Botanical Garden

and with the technical support of:

Conservation International-Center for Applied Biodiversity Science

Drafted by the ecosystem profiling team:

David C. Wege, Doug Ryan, Nigel Varty, Verónica Anadón-Irizarry, Amiro Pérez-Leroux

Assisted by individual experts from the following institutions:

Adventours
Association pour l'Etude et la protection des Vertébrés des petites Antilles
AMAZONA
American Bird Conservancy
Amigos de Sian Ka'an A.C.
Anguilla National Trust
Arizona State University
Asa Wright Nature Centre
Avian Eyes Birding Group
Bahamas Ministry of Tourism and Aviation
Bahamas National Trust
Bahamas National Trust, Bahamas Outdoors Limited
Bat Conservation International
Bermuda Audubon Society
Bonaire Parrot project, University of Sheffield
Boston University
British Virgin Islands National Parks Trust
CARE
Caribbean Coastal Area Management
Caribbean Natural Resources Institute
Centre d'Information Geospatiale
Centro de Aprendizaje para la Conservación de Sarapiquí
Centro para la Conservación y Ecodesarrollo de la Bahía de Samaná
The Claremont Colleges
Columbia University
CONHAME
Consorcio Ambiental Dominicano
Consultora Hernández
Cornell Laboratory of Ornithology
Department of Conservation Sciences, Bermuda
Department of Natural Resources and the Environment, Puerto Rico
Department of the Environment, Anguilla
Department of the Environment, Montserrat
Durham University
Dutch Caribbean Nature Alliance
Econcerns Ltd.
ENAF
Environment for the Americas
Environmental Awareness Group of Antigua and Barbuda
Environmental Management Division, Office of the Prime Minister (Jamaica)
Environmental Protection in the Caribbean
Faculté d'Agronomie et de Medicine Veterinaire
Fauna and Flora International
Fenad
Fermata Inc
Fondation EcosOphique
Fondation Macaya
Fondation Seguin
Forestry Department
Forestry, Wildlife and Parks Division- Dominica
Fundación para el Desarrollo Humano – PROGRESSIO
Grand Bahama Nature Tours
Grupo Jaragua, Inc.
Herpetological Conservation Trust
Institute of Jamaica, Natural History Museum of Jamaica
Institute of Marine Affairs
Instituto Tecnológico de Santo Domingo
Island Conservation
IUCN/SSC Iguana Specialist Group
Jadora International LLC
Jamaican Caves Organisation
Jamaica Forestry Department
Jardín Botánico Nacional
Klamath Bird Observatory
Laboratorio UASD-Steven
Ministère de l'Environnement, Haiti
Ministry of Energy and Mining
Ministry of Agriculture, Montserrat
Museo Nacional de Historia Natural
National Audubon Society
National Environment and Planning Agency
National Trust for the Cayman Islands
Natouraves
Negril Area Environmental Protection Trust

Northern Jamaica Conservation Association
Office National de la Chasse et de la Faune Sauvage
OJJUOES
Optics for the Tropics
Pacific Union College
Panos Caribbean
Parque Zoológico Nacional
Planning Institute of Jamaica
Plant Conservation Centre
Platte River Whooping Crane Maintenance Trust
Population Media Center
Programa Naciones Unidas para el Desarrollo
Puerto Rico Dept. Natural Resources
PWD Gun Club
Rare
Reseau d'Enseignement Professionnel et d'Interventions Ecologiques
Ross University School of Medicine, Dept of Biochemistry
Royal Society for the Protection of Birds
Secretaría de Estado de Educación Superior Ciencia y Tecnología/UASD
Secretaría de Estado de Medio Ambiente
Sociedad Ornitológica Hispaniola
Sociedad Ornitológica Puertoriqueña
Société Audubon Haïti
Société Financiere de Developpement
Society for the Conservation and Study of Caribbean Birds
South Dakota State University
State University of New York at Stony Brook
Stichting Nationale Parken Bonaire
Subsecretaría de Planificación y Desarrollo
Sustainable Grenadines Project
The Nature Conservancy
The Nature Conservancy-Dominican Republic
The Nature Conservancy-U.S. Virgin Islands
Trelawny Gun Club
Tourism Product Development Co. Ltd.
UCH/DES
UK Overseas Territories, Conservation Forum
UNDP
UNEP-Caribbean Environment Program
Universidad Autónoma de Santo Domingo
Universidad de Cornell
Université d'Etat d'Haiti
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University of California
University of Nebraska State Museum
University of New Brunswick
University of Pittsburgh, National Aviary
University of Puerto Rico
University of Scranton
University of Simon Bolivar
University of the West Indies
University of the West Indies – Cave Hill and Mona Campuses
University of the West Indies, Life Sciences
U.S. Agency for International Development / DAI
USDA Forest Service, Int'l Institute of Tropical Forestry
U.S. Fish and Wildlife Service
U.S. Fish and Wildlife Service, Div. Scientific Authority
U.S. Fish and Wildlife Service, Latin America and Caribbean Region
U.S. Forest Service, Wings Across the Americas
USFS International Institute for Tropical Forestry
U.S. Geological Survey
U.S. Virgin Islands Division of Fish and Wildlife
Vermont Center for Ecostudies
Wider Caribbean Sea Turtle Conservation Network
Windsor Research Centre
Zoological Museum of Amsterdam
Zoológico Nacional/Universidad Autónoma de Santo Domingo
Zoological Society of San Diego
Zoological Society of Trinidad and Tobago

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EXECUTIVE SUMMARY

Everyone depends on Earth's ecosystems and their life-sustaining benefits, such as clean air, fresh water and healthy soils. Founded in 2000, the Critical Ecosystem Partnership Fund (CEPF) has become a global leader in enabling civil society to participate in and benefit from conserving some of the world's most critical ecosystems. CEPF 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. As one of the founders, Conservation International administers the global program through a CEPF Secretariat.

CEPF provides grants for nongovernmental and other private organizations to help protect biodiversity hotspots, Earth's most biologically rich and threatened areas. The convergence of critical areas for conservation with millions of people who are impoverished and highly dependent on healthy ecosystems is more evident in the hotspots than anywhere else.

CEPF is unique among funding mechanisms in that it focuses on biological areas rather than political boundaries and examines conservation threats on a landscape-scale basis. From this perspective, CEPF seeks to identify and support a regional, rather than a national, approach to achieving conservation outcomes and engages a wide range of public and private institutions to address conservation needs through coordinated regional efforts.

The Caribbean Islands Hotspot includes the biologically and culturally diverse islands of the Bahamas, Greater Antilles, Virgin Islands, Cayman Islands, Lesser Antilles and the Netherlands Antilles. This represents a complex region of 12 independent nations and several British, Dutch, French and U.S. overseas territories. The hotspot supports exceptionally diverse ecosystems, ranging from montane cloud forests to cactus scrublands. It has dozens of highly threatened species, including two species of solenodon (giant shrews) and the Cuban crocodile.

Like its natural diversity, the cultural and socioeconomic diversity of the hotspot is incredibly high. It includes indigenous American, Hispanic, African, Anglo-Saxon, French and Asian cultures. With the exception of Haiti, which is the least-developed country in the Americas, the hotspot's nations are considered to be of middle to high income. But economic inequity is at high levels even in some of the richer countries and poverty is a concern across the region.

The Ecosystem Profile for the Caribbean Islands Hotspot was developed through a process of stakeholder consultation and expert research studies coordinated by BirdLife International (Caribbean Program) in collaboration with Durrell Wildlife Conservation Trust / Bath University, and the New York Botanical Garden, with technical support from Conservation International's Center for Applied Biodiversity Science. At least 200 stakeholders representing more than 160 governmental and nongovernmental institutions contributed to the development of this profile.

The ecosystem profile presents an overview of the hotspot in terms of its biological importance, climate change impacts, major threats to and root causes of biodiversity loss, socioeconomic context and current conservation investments. It provides a suite of measurable conservation outcomes, identifies funding gaps and opportunities for investment, and thus identifies the niche where CEPF investment can provide the greatest incremental value. It also contains a five-year investment strategy for CEPF in the region. This investment strategy comprises a series of strategic funding opportunities, termed strategic directions, broken down into a number of investment priorities outlining the types of activities that will be eligible for CEPF funding. The ecosystem profile does not include specific project concepts, as civil society groups will develop these as part of their applications for CEPF grant funding.

Conservation Outcomes

A systematic conservation planning process was undertaken to identify the highest priorities for conservation. The ecosystem profile identifies 290 key biodiversity areas and seven biodiversity conservation corridors for the Caribbean Islands Hotspot. Of the 290 key biodiversity areas identified for this profile, 209 contain coastal and marine ecosystems. Many of these sites provide habitat for important marine species. For instance, 18 key biodiversity areas harbor the highest densities of sea turtle nesting sites in the hotspot, with more than 100 crawls annually by globally threatened sea turtle species. Mangroves are a critical feature in a number of key biodiversity areas and all support exceptionally high numbers of globally threatened species. The corridors encompass groupings of these key biodiversity areas of high priority due to their importance for maintaining ecosystem resilience, ecosystem services values, and the health and richness of the hotspot's biological diversity.

Other Important Considerations

The diverse ecosystems and biodiversity of the region are subject to many immediate and long-term threats. The economy is heavily reliant on tourism, the growth of which will demand more land and will consume more resources, such as energy and water. Growth of mining in some countries, and its sometimes negative impact on human and environmental health, is a concern. Development and agriculture are taking a toll on fishing areas that are important as local food source and for employment and foreign exchange earnings. Invasive species and infectious disease also threaten habitats. Over-exploitation of resources, including hunting and collection of eggs, continue to take their toll. The hotspot is also vulnerable to the impacts of climate change. There is little awareness of the importance of ecosystem services and costs of their loss, and areas important for these services, such as wetlands, forest reserves and other protected areas, are undervalued. Policy and law in the region tends not to address the underlying causes of environmental issues, such as population increase. In addition, government and nongovernmental organizations charged with protecting the environment are hampered by a lack of capacity.

CEPF Niche and Investment Strategy

CEPF's niche for investment in the Caribbean Islands Hotspot was formulated through an inclusive, participatory process that engaged civil society, donor and governmental stakeholders throughout the region, and is based on an analysis of information gathered during the profile preparation process. While information from all countries in the hotspot has been compiled, this section focuses on determining where CEPF can add the greatest value in the following countries currently eligible to receive CEPF funds as both signatories to the Convention on Biological Diversity and World Bank client countries: Antigua and Barbuda, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines. In addition, the Bahamas and Barbados are included as priorities for CEPF investment because of their eligibility to receive GEF funds specifically.

Analysis and consultations conducted during the profile process demonstrate that the Caribbean Islands Hotspot is at a crossroad in its development trajectory. With few exceptions, most countries in the hotspot have built economies classified as middle income that are heavily reliant on ecosystem services, particularly for tourism, agriculture and fisheries. The region's ecosystems provide vital freshwater resources, help to mitigate the impacts of hurricanes, regulate local climate and rainfall, prevent soil erosion, produce hydroelectricity and yield locally consumed non-timber forest products. Additionally, the hotspot spans more than 4 million km^2 of ocean and has many thousands of kilometers of productive coastal and near-shore habitats. The coastal and marine environments are essential for the tourism and fisheries sectors. Both terrestrial and marine ecosystems host unique assemblages of flora and fauna of high global importance.

However, this profile also reveals that these island ecosystems are particularly fragile, finite and under significant pressure. The advent of climate change and its disproportionate impacts on the islands of the Caribbean, combined with continued population growth, emphasizes the importance of maintaining what intact ecosystems remain, of strengthening their resilience and of restoring degraded ecosystems. This imperative is not only critical for maintaining biodiversity but also has clear implications for the future welfare of the people of the Caribbean.

Important opportunities exist to leverage support for the kind of approaches that will help lay a foundation for a more sustainable economic base and future. Responsibility for natural resource management in the Caribbean lies primarily with national governments, which, together with international donors, are investing significant resources in natural resources management and conservation. However, the complexity of the challenge requires that civil society in all its various forms, from national environmental groups to small community-based organizations, must also fulfill a vital role as key advocates of and stewards for biodiversity and the benefits it provides for people.

CEPF's niche in the Caribbean Islands Hotspot will be to support civil society groups so that they can serve as effective advocates, facilitators and leaders for conservation and sustainable development of their islands. Civil society groups are in a unique position in the Caribbean to fulfill this role, as they have significant knowledge of and experience with the biodiversity held in individual key biodiversity areas and conservation corridors, and they can bridge local development aspirations with longer term conservation goals. In several islands, civil society groups have been the key advocates for development approaches that are environmentally sustainable, particularly for mining and tourism development. Their biological expertise, field experience and leadership role for environmental sustainability puts them in a unique position to help preserve their environment.

To ensure the greatest incremental contribution to the conservation of the global biodiversity values of the Caribbean Islands Hotspot, CEPF investment will focus on 45 of the highest-priority key biodiversity areas, many of which are embraced by six conservation corridors. Many of these key biodiversity areas are coastal and dependent on the health and resilience of the adjacent marine environment and as such, CEPF will adopt the 12-nautical-mile territorial sea definition established by the U.N. Convention on the Law of the Sea as the outermost limit for CEPF attention and investment. This means that conservation actions pertaining to a coastal key biodiversity area can include, as necessary, the belt of ocean measured seaward from the coastal nation and subject to its sovereignty. The full list of priorities is provided in the profile.

Four strategic directions will guide the CEPF investment, as follows:

Strategic Directions	Investment Priorities
1. Improve protection and management of 45 priority key biodiversity areas	1.1 Prepare and implement management plans in the 17 highest-priority key biodiversity areas
	1.2 Strengthen the legal protection status in the remaining 28 key biodiversity areas
	1.3 Improve management of invasive species in the 45 priority key biodiversity areas

	1.4 Support the establishment or strengthening of sustainable financing mechanisms
2. Integrate biodiversity conservation into landscape and development planning and implementation in six conservation corridors	2.1 Mainstream biodiversity conservation and ecosystem service values into development policies, projects and plans, with a focus on addressing major threats such as unsustainable tourism development, mining, agriculture and climate change
	2.2 Strengthen public and private protected areas systems through improving or introducing innovative legal instruments for conservation
	2.3 Prepare and support participatory local and corridor-scale land-use plans to guide future development and conservation efforts
	2.4 Promote nature-based tourism and sustainable agriculture and fisheries to enhance connectivity and ecosystem resilience and promote sustainable livelihoods
3. Support Caribbean civil society to achieve biodiversity conservation by building local and regional institutional capacity and by fostering stakeholder collaboration	3.1 Support efforts to build and strengthen the institutional capacity of civil society organizations to undertake conservation initiatives and actions
	3.2 Enable local and regional networking, learning and best-practice sharing approaches to strengthen stakeholder involvement in biodiversity conservation
4. Provide strategic leadership and effective coordination of CEPF investment through a regional implementation team	4.1 Build a broad constituency of civil society groups working across institutional and political boundaries toward achieving the shared conservation goals described in the ecosystem profile

This portfolio also includes special emergency support to Haitian civil society to mitigate the impacts of the 2010 earthquake. This support was approved separately by the Donor Council in March 2010 and has been incorporated as a fifth strategic direction, Provide emergency support to Haitian civil society to mitigate the impacts of the 2010 earthquake.

Conclusion

The Caribbean Islands Hotspot is one of the world's greatest centers of biodiversity and endemism, yet its biodiversity and the natural services it provides are highly threatened. Although the islands have protected areas systems, most are inadequately managed and important areas lack protection. This strategy will ensure that CEPF funds are employed in the most effective manner and generate significant conservation results that not only complement the actions of other stakeholders but also enable significant expansion of strategic conservation for the benefit of all.

INTRODUCTION

Everyone depends on Earth's ecosystems and their life-sustaining benefits, such as clean air, fresh water and healthy soils. Founded in 2000, the Critical Ecosystem Partnership Fund (CEPF) has become a global leader in enabling civil society to participate in and benefit from conserving some of the world's most critical ecosystems. CEPF 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. As one of the founding partners, Conservation International administers the global program through a CEPF Secretariat.

CEPF provides grants for nongovernmental and other private organizations to help protect biodiversity hotspots, Earth's most biologically rich and threatened areas. The convergence of critical areas for conservation with millions of people who are impoverished and highly dependent on healthy ecosystems is more evident in the hotspots than anywhere else.

CEPF is unique among funding mechanisms in that it focuses on biological areas rather than political boundaries and examines conservation threats on a landscape-scale basis. A fundamental purpose of CEPF is to ensure that civil society is engaged in efforts to conserve biodiversity in the hotspots, and to this end, CEPF provides civil society with an agile and flexible funding mechanism complementing funding currently available to government agencies.

CEPF promotes working alliances among community groups, nongovernmental organizations (NGOs), government, academic institutions and the private sector, combining unique capacities and eliminating duplication of efforts for a comprehensive approach to conservation. CEPF targets trans-boundary cooperation for areas rich of biological value that straddle national borders or in areas where a regional approach may be more effective than a national approach.

A recent, updated analysis reveals the existence of 34 biodiversity hotspots, each holding at least 1,500 endemic plant species, and having lost at least 70 percent of its original habitat extent (Mittermeier *et al*. 2005). The Caribbean islands qualify as one of these global biodiversity hotspots by virtue of their high endemicity and high degree of threat.

The Caribbean Islands Hotspot is exceptionally important for global biodiversity conservation. The hotspot includes important ecosystems, from montane cloud forests to coral reefs, and supports populations of unique species amounting to at least 2 percent of the world's total species.

The hotspot takes in the biologically and culturally diverse islands of the Bahamas, Greater Antilles, Virgin Islands, Cayman Islands, Lesser Antilles and the Netherlands Antilles. This represents a complex region of 12 independent nations and several British, Dutch, French and U.S. overseas territories (See Figure 1).

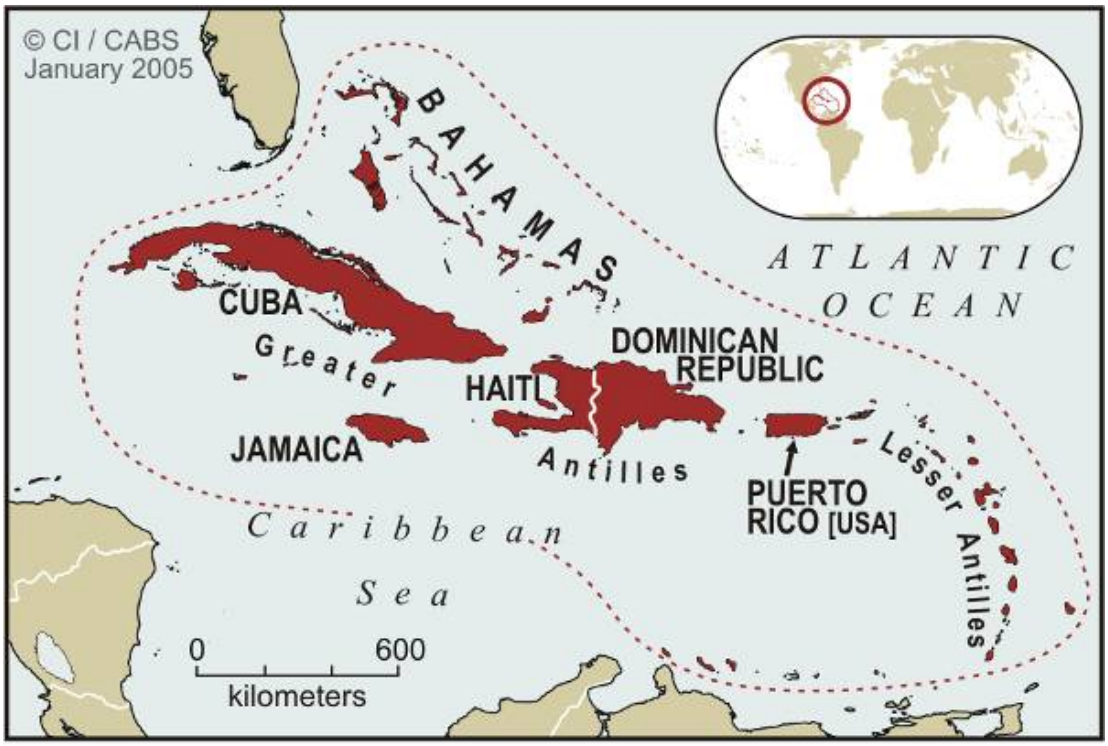
The Ecosystem Profile

The purpose of the ecosystem profile is to provide an overview of biodiversity values, conservation targets or "outcomes," and causes of biodiversity loss coupled with an assessment of existing and planned conservation activities in the hotspot and other relevant information. This information is then used to identify the niche where CEPF investment can provide the greatest incremental value for conservation. Consultations with diverse governmental and nongovernmental stakeholders are an integral part of the process, with the aim of creating a shared strategy from the outset. A CEPF investment strategy is an integral part of each ecosystem

profile. The ecosystem profile is also designed to enable other donors and programs to effectively target their efforts and thus complement CEPF investments.

Once the profile is approved by the CEPF Donor Council and a regional implementation team has been appointed, civil society organizations can propose projects and actions that fall within the identified strategic directions. The ecosystem profile does not define the specific activities that prospective implementers may propose, but outlines the strategy and investment priorities that will guide those activities. Applicants for CEPF funding are required to prepare proposals for the proposed activities and the performance indicators that will be used to monitor project success.

Figure 1. Map of the Caribbean Islands Hotspot



BACKGROUND

This ecosystem profile and five-year investment strategy for the Caribbean Islands Biodiversity Hotspot has been developed by BirdLife International (Caribbean Program) in collaboration with Durrell Wildlife Conservation Trust / Bath University, and the New York Botanical Garden, with technical support from Conservation International's Center for Applied Biodiversity Science.

Initial research and analysis at the regional level of easily accessible information sources provided draft biodiversity and thematic (or contextual) priorities that were subsequently reviewed by experts within the hotspot. The profiling process incorporated regional stakeholder expertise through three national workshops and one hotspot-wide workshop. Two-day national workshops were held in Dominican Republic, Haiti and Jamaica during June 2009, coordinated by Grupo Jaragua, Société Audubon Haiti and BirdLife Caribbean Program. They were attended by almost 100 individuals representing 58 institutions that assisted in analyzing current threats to biodiversity, inventorying conservation and development investment taking place within the region, and defining the biological site priorities. The hotspot-wide workshop was held in July

2009 on Antigua as an integral part of the 17th Regional Meeting of the Society for the Conservation and Study of Caribbean Birds. It was attended by more than 70 experts and contributors that helped review the Key Biodiversity Areas and also discuss the investment niche and strategy. National profile coordinators in Bahamas (Bahamas National Trust), Dominican Republic (Grupo Jaragua), Haiti (Société Audubon Haiti), Jamaica (BirdLife), Lesser Antilles (BirdLife on Barbados) and Puerto Rico (Sociedad Ornitológica Puertorriqueña) facilitated the gathering of information and review of priorities within their own countries. As a result (and in addition to the contributions made during the workshops), at least 200 individual experts representing more than 160 institutions have contributed to the ecosystem profile.

This profile focuses on conservation outcomes—biodiversity targets against which the success of investments can be measured—as the scientific basis for determining CEPF's geographic and thematic focus for investment. Such targets must be achieved by the global community to prevent species extinctions and halt biodiversity loss. These targets are defined at three levels: species (extinctions avoided), sites (areas protected) and landscapes (corridors consolidated). As conservation in the field succeeds in achieving these targets, these targets become demonstrable results or outcomes. While CEPF cannot achieve all of the outcomes identified for a region on its own, the partnership is trying to ensure that its conservation investments are working toward preventing biodiversity loss and that its success can be monitored and measured.

The development of the profile has been informed by a number of priority-setting exercises undertaken in the Caribbean during recent years, most notably *Important Bird Areas in the Caribbean: key sites for conservation* (BirdLife International 2008). Other important priority-setting and profiling exercises that have been used include The Nature Conservancy's ecoregional plan *Biodiversity Conservation Assessment of the Insular Caribbean* (Huggins *et al*. 2007); IUCN's *Situation Analysis for the Wider Caribbean* (Brown *et al*. 2007); and AGRIFOR Consult's report for the European Commission *Caribbean Regional Environmental Profile* (AGRIFOR Consult 2009). Information concerning sea turtle nesting beaches was secured from the Wider Caribbean Sea Turtle Conservation Network. Nationally, various gap assessment reports (e.g. the national Ecological Gap Assessment in Jamaica) have been referred to and used to inform biological and thematic priorities.

The marine realm is not a significant focus for this profile because the region merits its status as a hotspot due to threats to its terrestrial biodiversity. In addition, there is extensive information and investment currently focused on marine conservation in the Caribbean. The Caribbean Challenge, for example, is a landmark initiative in which Caribbean governments have pledged to expand their marine protected areas systems to include at least 20 percent of their near-shore area by 2020, develop sustainable financing for these systems and develop climate change adaptation projects. The initiative has secured more than $45 million in commitments from the international donor and environment community, much of it to support marine conservation. With the Caribbean Challenge's extensive coverage of the marine realm, the Caribbean's highest-priority unmet need for biodiversity conservation lays in the terrestrial realm. Furthermore, the terrestrial realm is where Caribbean civil society has a comparative advantage and critical role to play due to its unique knowledge and experience working on land and coastal conservation. However, this ecosystem profile does consider the marine environment and particularly some of the Caribbean's most important coastal and near-shore habitats in recognition of their global biological importance and benefits to people.

BIOLOGICAL IMPORTANCE OF THE CARIBBEAN

The Caribbean Islands Hotspot comprises 30 nations and territories, each characterized by unique and wide-ranging biodiversity and culture. It 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.

Habitats and Ecosystems

Geography, climate and the large geographic expanse of the Caribbean Islands Hotspot has resulted in a diverse range of habitats and ecosystems, which in turn support high levels of species richness. Although 14 Holdridge life zones and 16 WWF ecoregions have been defined in the hotspot, there are four major terrestrial forest types, the distribution and biodiversity characteristics of which are described below.

- Tropical/ Subtropical Moist Broadleaf Forests occur mainly in lowland areas influenced by north-easterly or north-westerly winds, and on windward mountain slopes, such as the northern part of eastern Cuba, northern Jamaica, eastern Hispaniola, northern Puerto Rico and small patches in the Lesser Antilles.

- Tropical / Subtropical Dry Broadleaf Forests are found in the Bahamas, Cayman Islands, Cuba, Hispaniola, Jamaica, the Lesser Antilles and Puerto Rico. The dry forest life zone tends to be favored for human habitation, largely because of relatively productive soils and reasonably comfortable climate. For this reason, few dry forests remain undisturbed.

- Tropical / Subtropical Coniferous Forests (both lowlands and montane) are found in the Bahamas, Turks and Caicos, Cuba and Hispaniola where they are often threatened by timber extraction and frequent man-made fires that change their age structure and density.

- Shrublands and Xeric Scrub occurs in areas of rain shadows created by mountains, and also in the more arid climate of the southern Caribbean (e.g. Aruba, Bonaire and Curaçao). Xeric shrublands and cactus scrub are found where suitable conditions occur throughout the Lesser Antilles and on Cuba.

The Caribbean Islands Hotspot also supports important freshwater habitats, including large lowland rivers, montane rivers and streams, lakes, wetlands and underground karst networks. In addition to providing habitat for many important, unique and migratory animals and plants, these freshwater sites provide clean water, food and many services to local communities. These services are especially important as the small islands of the insular Caribbean are surrounded by salt water, and rely greatly on limited, land-based freshwater from functional ecosystems.

With the majority of Caribbean people living close to the shoreline, coastal ecosystems, including mangroves, beaches, lagoons and cays, are essential not only for biodiversity, but for buffering coastal communities from the effects of storms, providing a basis for recreational and tourism industries, as well as nursery habitat for commercial species.

Species Diversity, Endemicity and Global Threat Status

The Caribbean Islands Hotspot supports a wealth of biodiversity within its diverse terrestrial ecosystems, with a high proportion of endemicity making the region biologically unique. It includes about 11,000 plant species, of which 72 percent are endemics. For vertebrates, high proportions of endemic species characterize the herpetofauna (100 percent of 189 amphibian species and 95 percent of 520 reptile species), likely due to their low dispersal rates, in contrast to

the more mobile birds (26 percent of 564 species) and mammals (74 percent of 69 species, most of which are bats). Species endemic to the hotspot represent 2.6 percent of the world's 300,000 plant species, and 3.5 percent of the world's 27,298 vertebrate species.

By percentage, amphibians and mammals are the most threatened of the taxonomic groups assessed, at 77 percent and 39 percent respectively (see Table 1).

Table 1. Terrestrial Species Diversity, Endemicity and Global Threat in the Caribbean Islands Hotspot

Taxonomic Group	Species	Hotspot endemics	% Endemism	Globally Threatened	% Threatened
Mammals	69	51	74	27	39
Birds	564	148	26	51	9
Reptiles	520	494	95	37	7
Amphibians	189	189	100	145	77
Freshwater fish	167	65	39	5	3
Plants	11,000	7,868	72	438	4
Total	12,509	8,817	70	703	6

The high level of biological diversity in the Caribbean is due to several factors. Geologically, the hotspot has a complex history, with the Greater Antilles forming in the Pacific Oceans more than 200 million years ago, when it was attached to what is today the Yucatan Peninsula. During its eastward migration between the Americas, the Caribbean collided with other land forms along South America, creating unique landscapes and bedrock. The Lesser Antilles are the active remnants of an ancient volcanic chain, and are geologically much younger than the larger islands to the west and north. This geologic complexity provides the basis for species that find their origin along both the Pacific and Atlantic coasts of Central America. Further, several islands have particularly rugged and mountainous landscapes separated by large stretches of sea, which has resulted in the isolation of populations and eventually to speciation.

The Caribbean Islands Hotspot forms the heart of Atlantic marine diversity. Roughly 8 percent to 35 percent of species within the major marine taxa found globally are endemic to the hotspot. The shallow marine environment contains 25 coral genera (62 species scleractinian coral), 117 sponges, 633 mollusks, over 1,400 fishes, 76 sharks, 45 shrimp, 30 cetaceans and 23 seabirds. The Caribbean contains approximately 10,000 square kilometers of reef, 22,000 square kilometers of mangrove, and as much as 33,000 square kilometers of seagrass beds.

Within the hotspot, however, little variation in marine species diversity exists because of the high degree of connectivity. The strong and predictable Caribbean Current meanders through the basin year round transporting larvae between the islands. As a result, marine habitats share many of the same marine species in contrast to the region's terrestrial biodiversity with its high rates of endemism. Large ranging and highly migratory species such as turtles, whales, sea birds and pelagic fishes inhabit different portions of the Caribbean basin during different stages of life. Despite this high degree of mixing, there are significant differences in geology, climate, productivity, and island size, all of which influence the relative abundance, extent, intactness, and vulnerability of marine biodiversity in the Caribbean.

CONSERVATION OUTCOMES

This ecosystem profile includes a commitment and emphasis on using conservation outcomes as the scientific underpinning for determining conservation priorities. Conservation outcomes are the full set of quantitative and justifiable conservation targets in a hotspot that need to be achieved to prevent biodiversity loss. The selection of conservation outcomes relies on the understanding that biodiversity is not measured in any single unit. Rather, it is distributed across a hierarchical continuum of ecological scales that can be categorized into three levels: species, sites and corridors. These levels interlock geographically through the occurrence of species at sites and of species and sites in corridors. Given threats to biodiversity at each of the three levels, targets for conservation can be set in terms of "extinctions avoided" (species outcomes), "areas protected" (site outcomes), and "corridors consolidated" (corridor outcomes).

Conservation outcomes are defined sequentially, with species outcomes defined first, then site outcomes and, finally, corridor outcomes. Since species outcomes are extinctions avoided at the global level, they relate to globally threatened species, in the IUCN Red List categories of Critically Endangered, Endangered and Vulnerable. This definition excludes data-deficient species, which are considered to be priorities for further research but not necessarily for conservation action. It also excludes those species that are threatened locally and may be high national or regional priorities, but not high global priorities. Species outcomes are met when a species' global threat status improves or, ideally, when it is removed from the Red List. This derivation of conservation targets is based on a global standard: *The IUCN Red List of Threatened Species* (www.redlist.org). The 2008 IUCN Red List represented the best available data source on the global conservation status of species at the time the profile was developed.

Because most globally threatened species are best conserved through the protection of a network of sites where they occur, the process of defining conservation outcomes also focuses on identifying a comprehensive set of key biodiversity areas. The most important criterion for defining key biodiversity areas is the regular occurrence of significant numbers of one or more globally threatened species. In addition to the occurrence of globally threatened species, key biodiversity areas can also be defined on the basis of the occurrence of restricted-range species and congregatory species. Sites regularly supporting significant populations of restricted-range species are global conservation priorities because there are few or no other sites in the world where conservation action for these species can be taken. This criterion is currently only used to define key biodiversity areas for birds, as this is the only group for which the concept of restricted-range species has been quantitatively defined: species with a global breeding range of less than 50,000 km^2 (Stattersfield *et al.* 1998). However, to prevent a bias toward site priorities for birds, key biodiversity areas in the Caribbean Islands Hotspot are not identified based on the presence of restricted-range species or congregatory species, but only by the presence of globally threatened species occurring within them.

The starting point for defining key biodiversity areas in the Caribbean Islands Hotspot was the Important Bird Area (IBA) network in each country, identified by BirdLife International partners and collaborating organizations in 2008. With the identification of key sites for bird conservation, completing the identification of site outcomes required supplementing the IBAs by defining key biodiversity areas for other taxonomic groups through analyses of regionally accessible data and literature, followed by consultation with local experts in each country..

While the protection of a network of sites is often sufficient to conserve many elements of biodiversity in the medium term, the long-term conservation of all elements of biodiversity

requires the consolidation of inter-connected landscapes of sites through conservation corridors to ensure broad-scale ecological and evolutionary processes and ecosystem resilience.

To support longer-term conservation, corridors are defined wherever connectivity between two or more key biodiversity areas is necessary to meet the long-term conservation needs of the biodiversity. They also are defined wherever it is necessary to increase the area of actual or potential natural habitat in order to maintain evolutionary and ecological processes. In the latter case, emphasis is placed on maintaining connectivity of natural habitat across environmental gradients, particularly altitudinal gradients, to maintain such ecological processes as migration of bird species and to safeguard against climate change impacts. In the Caribbean Islands Hotspot, the corridors were defined in consultation with local experts, complemented by analysis of additional data layers. Due to the fragmented nature of an island-based hotspot (and in the case of the Caribbean, often with isolated key biodiversity areas/habitats set within developed or heavily degraded landscapes), defining landscape-scale outcomes is not always appropriate.

In theory, within any given region, or, ultimately, for the whole world, conservation outcomes can be defined for all taxonomic groups. However, outcome definition is dependent on the availability of data on the global threat status of all taxa and on the distribution of globally threatened species among sites and across corridors. In the Caribbean Islands Hotspot, because these data for terrestrial taxa are only available for mammals, birds, amphibians and, to a lesser degree, reptiles, fish and plants, outcomes were only defined for these groups at this time.

Species Outcomes

The Caribbean's biodiversity is at serious risk of species extinctions. More than 700 species are globally threatened, making the Caribbean one of the top hotspots assessed by CEPF for globally threatened species. A full list of the globally threatened terrestrial species developed for this ecosystem profile is available in the supplemental appendices for this ecosystem profile on www.cepf.net. The hotspot is considered to be of very high importance for global amphibian conservation due to the high rates of speciation and endemism, and exceptionally high levels of threat (see Table 2).

Table 2. Summary of Species Outcomes for the Caribbean Island Hotspot

Taxonomic Group	Critically Endangered	Endangered	Vulnerable	Total
Mammals	6	6	15	27
Birds	12	16	23	51
Reptiles	18	9	10	37
Amphibians	64	61	20	145
Freshwater fish	0	0	5	5
Plants	95	126	216	428
Total	195	218	289	703

Amphibians

All of the 189 native species of amphibian in the Caribbean Islands Hotspot are endemic, many to single islands. The Caribbean stands out globally, with by far the highest percentage (75 percent; 145 species) of threatened or extinct amphibian species of any region. In a list of countries with the highest percentage of threatened and extinct amphibians, the top five countries are all in the

Caribbean. One place in particular, the Massif de la Hotte in southwest Haiti is regarded as one of the most important sites in the world for amphibian conservation as it hosts around 28 globally threatened species, many of which are restricted to this single mountain range.

Amphibians of the hotspot all belong to five frog families (A*romobatidae, Bufonidae, Dendrobatidae, Hylidae* and *Leptodactylidae*) but the taxon is dominated by the 161 species of the *Eleutherodactylus* genus. These forest frogs are distinctive due to their direct development (i.e. they bypass the tadpole stage), egg-laying on the ground and parental egg guarding. One species, E*leutherodactylus iberia*, from Cuba is the second smallest tetrapod in the world at just less than 1 cm in length. At the other end of the scale, the mountain chicken (*Leptodactylus fallax*) from Montserrat and Dominica is, at 16 centimeters, one of the largest of all frogs. This species is one of the latest to fall victim to the infectious disease caused by the chytrid fungus (*Batrachochytrium dendrobatidis)* and, compounded by the historical impacts of habitat loss, invasive species and exploitation, is rapidly declining toward extinction in the wild. The disease has also been implicated in the rapid declines and possible extinctions of a number of *Eleutherodactylus* species in Puerto Rico, Dominican Republic, Haiti and Cuba. In contrast to the reptiles, the amphibians have been systematically assessed against Red List criteria.

Mammals

Historically, the Caribbean Islands supported 92 terrestrial mammal species, of which 23 are now considered extinct. Of the 69 extant species, 51 are endemic to the hotspot and 27 species are globally threatened, which amounts to 39 percent of known mammal species. These were assessed as part of the Global Mammal Assessment completed by IUCN and Conservation International in 2008 with the support of CEPF and other donors.

Solenodontidae and *Capromyidae* are two Greater Antilles endemic rodent families that are threatened and are high priorities for conservation. The family *Solenodontidae* includes two surviving species, the Endangered Cuban solenodon (*Solenodon cubanus*) and Hispaniolan solenodon (*Solenodon paradoxus*). The Cuban solenodon occurs in two national parks: Alejandro de Humboldt and Sierra del Cristal. The Hispaniola solenodon is known in Haiti from only Massif de la Hotte and in the Dominican Republic it has a more widespread distribution. The main threats are habitat loss due to increasing human activity and deforestation, and the introduction of exotic predators, such as dogs, cats and mongooses. The family *Capromyidae* (the “hutias”) includes 20 species of rodents of which 19 occur within the hotspot. Six of these hutias are extinct due to hunting, habitat loss and predation from invasive species. The 13 species that remain are country-specific species with 10 species occurring in Cuba, and single endemic species occurring in each of Bahamas, Jamaica and Hispaniola. However, two of the Cuba endemics are considered “possibly extinct,” namely the Critically Endangered dwarf hutia (*Mesocapromys nanus*) and little Earth hutia (*Mesocapromys sanfelipensis*). Endangered Cabrera's hutia (*Mesocapromys angelcabrerai*) and large-eared hutia (*Mesocapromys auritus*) are restricted to single sites on the Cuban islands of Cayos de Ana María and Cayo Fragoso respectively, and are also in a precarious state.

Bats are very important components of ecosystems within the Caribbean, and are represented by 51 species, of which 35 are endemic and 13 are globally threatened. However, the bats are in urgent need of research focused on their distribution, ecology and current status. These species are sparsely distributed and difficult to find due to the limited number of suitable caves or suitable old-growth (native) trees appropriate for roosting. For example, Critically Endangered Cuban greater funnel-eared bat (*Natalus primus*) is only known from Cueva La Barca in Guanahacabibes and Jamaican greater funnel-eared bat (*Natalus jamaicensis*) from St. Clair Cave in Point Hill and one sighting from Portland Cave within the Portland Ridge and Bight area.

Birds

More than 560 species of bird have been recorded in the Caribbean Islands Hotspot (Raffaele *et al*. 1998). Of these, 148 species are endemic to the hotspot with 105 of them confined to single islands. Nine percent are classified as globally threatened. Although endemism is most notable at the species level, a remarkable 36 genera of birds are endemic to the hotspot, as well as two endemic families. More than 120 bird species (one of which is globally threatened) migrate from their breeding grounds in North America to winter in the Caribbean, and thus constitute a high proportion of the birds present in many habitats, especially in the Bahamas and the Greater Antilles.

BirdLife International recognizes six primary and two secondary Endemic Bird Areas within the Caribbean Hotspot, a testament to the diversity and island-specific endemism in this region. BirdLife International is the Red List Authority for birds and as such it provides all the data for birds that appear on the Red List. All bird species are reassessed every four years (most recently in 2008); with *ad hoc* updates carried out on an annual basis where new information indicates a revision may be necessary. There are 51 Caribbean Islands Hotspot bird species currently listed as globally threatened (9 percent of the hotspot's birds), 48 of which are confined to the hotspot and 11 of which are considered Critically Endangered such as ivory-billed woodpecker (*Campephilus principalis),* Ridgway's hawk (*Buteo ridgwayi),* Grenada dove *(Leptotila wellsi*) and Montserrat oriole (*Icterus oberi*). At least 10 species of Caribbean birds have gone extinct during the last 500 years, including six species of *Ara* macaws. The Cuban macaw (*Ara tricolor*), the last of the six to disappear, was hunted to extinction for food and the pet trade during the second half of the 18th century. Birds represent some of the most important symbols for conservation in the Caribbean. The parrots, including Vulnerable St. Vincent parrot (*Amazona guildingii*) and St. Lucia parrot (*Amazona versicolor*) and Endangered imperial parrot (*Amazona imperialis*) of Dominica have all represented successful flagship species for species and habitat conservation, as well as raising environmental awareness in their respective islands.

Reptiles

With more than 520 native species the Caribbean islands are very rich in reptiles, the vast majority of which (c. 95 percent) are endemic to the region. Two major evolutionary radiations dominate the lizards; the anoles (*Anolis*, 157 species) and dwarf geckos (*Sphaerodactylus*, 86 species). Notable reptile taxa also include the striking rock iguanas (*Cyclura*, 9 species), all of which are globally threatened, and the poorly known and elusive galliwasps (26 species in two genera, *Celestus* and *Diploglossus*), some of which are feared extinct. Two of the smallest lizards in the world can be found in the Caribbean: *Sphaerodactylus ariasae* from the Dominican Republic and *S. parthenopion* from the U.S. Virgin Islands. Snakes are made up of 145 native species in nine families, and include major radiations such as the *Tropidophis* genus (26 species), a group of dwarf boas, and the *Typhlops* genus (41 species), the fossorial blindsnakes. The world's smallest snake - *Leptotyphlops carlae* – was recently discovered in Barbados (Hedges 2008). Extinction risk of the Caribbean reptiles has not been systematically assessed, with only 47 species (excluding extinct species) having been evaluated against Red List criteria. Of these, 37 are globally threatened. However, a very large number of highly restricted-range reptiles occur in the Caribbean, many of which will probably qualify as globally threatened once assessed. In terms of sea turtles, two Critically Endangered species (leatherback and hawksbill) and two Endangered species (green and loggerhead) nest in the Caribbean.

Plants

The Caribbean Islands Hotspot is home to 1,447 native genera and about 11,000 native species of seed plants (*Cycadopsida, Coniferopsida, Magnoliopsida,* and *Liliopsida*). Generic endemism is especially noteworthy, with about 13.2 percent comprising 191 genera that are endemic or nearly so, to the region. There are 7,868 native species of seed plants endemic to the Caribbean Hotspot, amounting to about 72 percent species' endemism for region overall. These figures make the Caribbean very important for plant conservation, particularly in view of the hotspot's relatively small size in comparison to other hotspots.

A total of 439 plant species are globally threatened. These species are overwhelmingly woody plants, principally *Magnolipsida*, *Coniferopsida*, and *Cycadopsida*; the only *Liliopsida* assessed are 15 species of *palmae*. The only other plant species recognized as globally threatened are two species of *Marchantiopsida*. Notable by their absence from the assessment are any species of *Orchidaceae* and *Cactaceae*, two of the most important plant families for species that are threatened by illegal trade. In addition to the taxonomic unevenness of the plant species that have been assessed using current criteria, there is a wide variance in proportion of seed plant species that have been assessed for the various islands, relative to their known species' composition. Cuba, for example, with 5,991 species known, has 163 species listed as globally threatened by the 2008 *IUCN Red List*, whereas Jamaica, with far fewer known species (2,540), has 209 species listed. Fortunately, active efforts are underway in several Caribbean countries to update and complete an assessment of their threatened species using modern criteria. Results of such efforts, which are being undertaken by the scientists who know the flora intimately, need to be evaluated by IUCN and incorporated into its global Red-Listing process. These taxonomic and geographic gaps in the information on globally threatened plants are impediments to a full assessment of the endangerment of plants in the Caribbean Islands and other biodiversity hotspots.

The source for data reported in this section and for information on geographic distribution, synonyms and taxonomic literature on Caribbean seed plants is http://persoon.si.edu/antilles/westindies/index.htm. An additional source for information on West Indies' plants and fungi is the Caribbean Biodiversity Portal of The New York Botanical Garden, http://sweetgum.nybg.org/caribbean/index.php.

Freshwater Fish

The hotspot supports 167 species of freshwater fish, about 65 of which are endemic to one or a few islands, and many of these to just a single lake or springhead. As in other island hotspots, there are two distinct groups of freshwater fishes in the Caribbean: On smaller and younger islands, most fish are species that are widespread in marine waters but also enter freshwater to some degree, while on the larger and older islands of the Greater Antilles, there are several groups that occupy inland waters, including gars, killifishes, silversides and cichlids. Only five of the estimated 160 species of freshwater fishes are recognized as globally threatened, although data on these freshwater fish are not lacking in the literature and a re-assessment of the 65 endemics is long overdue.

Marine Species

A detailed analysis of marine species was not undertaken during the profile process as previously explained, however the species outcomes for the Caribbean Islands Hotspot marine environment will extend to all globally threatened species known within the inshore environment. In the region, globally accepted threat assessments have been completed for all species of sharks and rays, groupers, wrasses, corals, seagrasses, macroalgae and mangroves.

Globally, the Caribbean basin has the largest proportion of corals categorized under high risk for extinction. Corals have experienced an 80 percent reduction in cover since the mid-1970s. The precipitous declines of two key species, staghorn (*Acropora cervicornis*) and elkhorn (*Acropora palmata*) corals, both now Critically Endangered, is of major concern since the loss of these once prominent species has had major ecological impacts on entire reef systems. Another major Caribbean reef builder, the boulder star coral (*Montastraea annularis)* is Endangered because of rapid declines during the last decade. It is the largest coral species in the region and is highly susceptible to disease that can kill a 500-year old colony within months, with recovery unlikely for decades. Although the steep decline of coral reefs started 30 years ago, reef fish populations have demonstrated significant declines only in the last decade. Overall reef fish density has declined 2.7 percent to 6.0 percent per year throughout the region. The next hardest hit taxonomic group is mangroves, whose cover has declined by 42 percent during the past 25 years. Large fauna also have been severely impacted by human activity. Small populations of manatees and saltwater crocodiles still occur on all of the Antilles but are restricted to a very small portion of their original distribution. Globally threatened sea turtles found in the region include Critically Endangered leatherback (*Dermochelys coriacea)* and hawksbill (*Eretmochelys imbricata*) and Endangered green (*Chelonia mydas)* and loggerhead (*Dermochelys coriacea*) turles.

Site Outcomes

A total of 290 key biodiversity areas have been defined for all the countries and territories in the Caribbean Islands Hotspot. For Cuba, the site outcomes include only IBAs as it was not possible to incorporate the results of analysis of other taxonomic groups and consultations with experts for the definition of other site outcomes at this time. However, all IBAs qualify as key biodiversity areas, are of global biodiversity importance and provide important benefits for other species. It is also hoped that the results of the additional site outcome analysis for Cuba may be made available at a later date.

Among the other countries included in this analysis, those with the greatest numbers of key biodiversity areas are the large islands of the Greater Antilles and the multi-island countries such as the Bahamas (see Table 3 and Appendix 1). This is to be expected as the principles of island biogeography dictate that the larger and older the island, the greater the species diversity. Higher species diversity on each of the Greater Antilles, combined with greater ecosystem, habitat and altitudinal diversity has led to large numbers of endemic species and consequently higher numbers of globally threatened taxa. Archipelagos such as the Bahamas result in taxonomic isolation, and globally threatened species occupying very small ranges that in turn has led to relatively large numbers of key biodiversity areas being defined.

Table 3. Summary of Key Biodiversity Areas by Country in the Caribbean Islands Hotspot

Country/ territory	Key Biodiversity Areas
Anguilla (to U.K.)	6
Antigua and Barbuda	10
Aruba (to Netherlands)	1
Bahamas	26
Barbados	4
Cayman Islands (to U.K.)	8
Cuba	28
Dominica	4
Dominican Republic	35
Grenada	9
Guadeloupe (to France)	8
Haiti	17
Jamaica	38
Martinique (to France)	8
Montserrat (to U.K.)	3
Netherlands Antilles	7
Puerto Rico (to USA)	28
St. Barthélemy (to France)	4
St. Kitts and Nevis	1
St. Lucia	6
St. Martin (to France)	1
St. Vincent and the Grenadines	7
Turks and Caicos Islands (to U.K.)	11
Virgin Islands (to U.K.)	7
Virgin Islands (to USA)	13
TOTAL Key Biodiversity Areas	**290**

* Note: Cuban key biodiversity areas comprise only sites (IBAs) identified as important for globally threatened birds

Table 4 indicates that of the 290 key biodiversity areas, 140 were defined for globally threatened birds, followed by 124 for reptiles, 99 for amphibians, 96 for plants, 62 for mammals and 18 for sea turtles. No key biodiversity areas were defined for freshwater fish, most likely because only five freshwater fish have been assessed as globally threatened.

Table 4. Summary of Key Biodiversity Areas by Taxonomic Group in the Caribbean Islands Hotspot

Taxonomic group	Total Key Biodiversity Areas
Mammals	62 (21%)
Birds	140 (48%)
Reptiles	124 (43%)
Amphibians	99 (34%)
Plants	96 (33%)
Total Key Biodiversity Areas	**290**

Note: The key biodiversity areas identified in Cuba were defined based on globally threatened birds, but with further analysis many of them would be shown to be significant for other taxonomic groups.

Of the 290 key biodiversity areas identified for this profile, 209 contain coastal and marine ecosystems. Many of these sites provide habitat for important marine species. For instance, 18 key biodiversity areas harbor the highest densities of sea turtle nesting sites in the hotspot, with more than 100 crawls annually by globally threatened sea turtle species. Mangroves are a critical feature in a number of key biodiversity areas, including Portland Ridge and Bight and Black River Great Morass in Jamaica, Jaragua National Park and Haitises in the Dominican Republic and Southern Great Lake in Bahamas. The Black River Lower Morass is a diverse set of habitats, where five rivers meet, including wetlands, mangroves and marshland containing the largest crocodile population in Jamaica. The Portland Bight Protected Area is rich in wildlife with the largest almost continuous mangrove stands remaining in Jamaica. The wetlands support many waterfowl and crocodile, which, together with the extensive sea-grass beds in the waters of the Bight provide probably the largest nursery area for fish, crustaceans and mollusks on the island. It also supports 4,000 of Jamaica's 16,000 fishers and their families. The Jaragua National Park has an extensive marine sector with high densities of sea grass beds and coral reefs. Some of the Caribbean's marine protected areas are also included directly within the key biodiversity areas identified.

Other key biodiversity areas also support exceptionally high numbers of globally threatened species, including Cockpit Country and Blue Mountains in Jamaica and Massif de la Hotte in Haiti, all of which are known to support more than 40 globally threatened species. Forty-six key biodiversity areas are regarded as wholly irreplaceable on a global scale because they contain the only known populations of a globally threatened species (see Table 5). Since the sites are irreplaceable for Critically Endangered and Endangered species, they qualify as Alliance for Zero Extinction (AZE) sites, the most urgent site-level conservation priorities on a global scale. The Caribbean Island Hotspot possesses some of the highest-ranking AZE sites in the world.

Table 5. **Wholly Irreplaceable Sites in the Caribbean Islands Hotspot**

Key Biodiversity Area	Country		Key Biodiversity Area	Country
Alejandro de Humboldt	Cuba		Los Quemados	Dominican Republic
Anegada: Western salt ponds and coastal areas	Virgin Islands (to U.K.)		Maricao and Susúa	Puerto Rico (to USA)
Arikok National Park	Aruba (to Netherlands)		Massif de la Hotte	Haiti
Blue Mountains	Jamaica		Massif de la Selle	Haiti
Bluefields	Jamaica		Massif forestier de l'île de Basse-Terre	Guadeloupe (to France)
Booby Pond Nature Reserve	Cayman Islands (to U.K.)		Mona y Monito	Puerto Rico (to USA)
Carite	Puerto Rico (to USA)		Morne Trois Pitons National Park	Dominica
Catadupa	Jamaica		Mount Diablo	Jamaica
Centre Hills	Montserrat (to U.K.)		Negril	Jamaica
Ciénaga de Zapata	Cuba		Offshore Islands	Antigua and Barbuda
Cockpit Country	Jamaica		Parque Nacional Jaragua	Dominican Republic
Cordillera Central	Puerto Rico (to USA)		Plaisance	Haiti
Culebra	Puerto Rico (to USA)		Point Sables	St. Lucia
Dame-Marie	Haiti		Portland Ridge and Bight	Jamaica
Dolphin Head	Jamaica		Presqu'ile du Nord-Ouest I	Haiti
El Yunque	Puerto Rico (to USA)		Presqu'ile du Nord-Ouest II	Haiti
Government Forest Reserve	St. Lucia		Rocher du Diamant	Martinique (to France)

Key Biodiversity Area	Country		Key Biodiversity Area	Country
Hellshire Hills	Jamaica		Sabana Seca	Puerto Rico (to USA)
Ile de la Tortue Forest	Haiti		Salinas de Punta Cucharas	Puerto Rico (to USA)
John Crow Mountains	Jamaica		Santa Cruz Mountains	Jamaica
Karso del Norte	Puerto Rico (to USA)		Scotland District	Barbados
Karso del Sur	Puerto Rico (to USA)		Vieques	Puerto Rico (to USA)
Litchfield Mountain - Matheson's Run	Jamaica		Virgin Gorda	Virgin Islands (to U.K.)
Loma La Humeadora	Dominican Republic			
Los Haitises	Dominican Republic			

* Note: Cuban sites relate solely to those identified as important for globally threatened birds.

Massif de la Hotte, at 128,700 hectares, has been officially recognized 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). It embraces a mosaic of remnant broadleaf forest and degraded land, surrounded by lands supporting no forest or trees. A diversity of microclimates created by the rugged topography—along with an abundance of bromeliads that are ideal habitat for amphibians—have created an environment that is particularly supportive for speciation. 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.

Other key biodiversity areas of exceptional ranking are Cockpit Country and Dolphin Head in Jamaica. Cockpit Country supports the largest number of globally threatened species of any key biodiversity area in the Caribbean Islands Hotspot, with 59 (including 11 amphibians and 40 plant species). The area is a unique expanse of wet forest on a limestone karst landscape. Agriculture (and invasive plant species) dominates the low, flat lands, with forest covering the mountains. Cockpit Country is the source for freshwater used by 40 percent of Jamaicans, and the area is essential in moderating the flow and preventing flooding of a number of western Jamaica’s rivers. Dolphin Head Key Biodiversity Area is an isolated limestone mountain area in western Jamaica. This isolation has led to the development of a unique flora, but being surrounded by agricultural lands, the area and its endemic, globally threatened species are under huge pressure.

The Dominican Republic, Haiti, Jamaica and Puerto Rico all have multiple AZE sites, while Antigua and Barbuda, Barbados, Cayman Islands, Dominica, Guadeloupe, Martinique and the British Virgin Islands have at least one AZE site. These high ranking AZE sites are particularly important for conservation due to their having very high numbers of Critically Endangered and Endangered species. As the comprehensiveness of available data on the distribution of globally threatened species among key biodiversity areas varies significantly among taxonomic groups, key biodiversity areas identified as being important for the conservation of one taxonomic group may also be important for other groups for which data are not yet available. In addition, there are likely to be other important sites for the conservation of globally threatened species in the region that have not been identified during this process, especially for plants, reptiles and fish.

The key biodiversity areas not only stand out for their biological attributes, they also emerge as exceptionally important for the ecosystem services they provide to the Caribbean community. As

a hotspot comprised of islands, the interrelationship between the key biodiversity areas, their provision of ecosystem services and the welfare of Caribbean human populations is inextricable. Local populations are highly dependent on their finite and vulnerable resources. For example, the Massif de la Selle Key Biodiversity Area in Haiti is a major source of water to the inhabitants of Port-au-Prince. The Massif de la Hotte (also Haiti) covers three priority watersheds that serve the cities of Les Cayes, Port Salut, Tiburon and Jeremie. These cities typically suffer the greatest loss of life due to flooding and landslides resulting from hurricanes and tropical storms, in part due to the degradation of the upper watershed. The Blue and John Crow Mountains key biodiversity areas in Jamaica are the source of water for the entire eastern end of Jamaica (including the capital Kingston), while Cockpit Country Key Biodiversity Area (and the adjacent key biodiversity areas of Catadupa and Litchfield Mountain – Matheson's Run) is the source of fresh water for the remainder of Jamaica's human population. Coastal key biodiversity areas with fringing reefs and mangrove, such as Portland Sound and Bight Key Biodiversity Area in southern Jamaica, provide essential disaster mitigation services such as protection from storm surges and are also economically important for their fisheries.

Other key biodiversity areas are the focus of income generating activities such as tourism, with montane key biodiversity areas such as the Blue Mountains in Jamaica and Armando Bermudez National Park in Dominican Republic representing major tourist destinations for hikers and birdwatchers. With huge pressure on land to provide food for growing populations throughout the Caribbean there are few examples of key biodiversity areas being used sustainably for agriculture or for non-timber forest products. Utilization of the forests occurs throughout the hotspot and many people rely on these resources, but this is also a major threat to the region's biodiversity.

A significant percentage of Caribbean key biodiversity areas are inadequately protected. Of the 290 key biodiversity areas, 184 (63 percent) are designated as IBAs. Based on an extrapolation of the IBA data, the profile estimates about 165 key biodiversity areas (57 percent) are partially or wholly within formal protected area systems, under national parks, wildlife reserves, forest reserves, etc. The remaining 125 sites (43 percent) consist of a range of landscape and administrative units of varying scales on private and government lands, but lack any form of biodiversity conservation designation. Furthermore, many of the officially designated protected areas are inadequately managed. They confront a host of threats.

Corridor Outcomes

Seven conservation corridors were defined in the hotspot with the exception of Cuba because of the limitation to its site outcomes, as previously explained. These corridors encompass groupings of key biodiversity areas of high priority due to their importance for maintaining ecosystem resilience, ecosystem services values, and the health and richness of the hotspot's biological diversity. The immediate management goals are to maintain and increase connectivity, ensure sustainable management of the landscape and increase the area of actual or potential natural habitat under protection where appropriate. The maintenance of ecosystem functionality and resilience takes on particular significance as options are sought to mitigate the impacts of climate change. The identification of corridor outcomes is not always relevant in the hotspot due to the small land area of many islands and to the high fragmentation of the landscape on other islands.

The seven corridors are located in four countries: Haiti, Dominican Republic, Jamaica and St. Vincent. Between them, the seven corridors embrace important populations of more than 220 globally threatened species and 38 key biodiversity areas. The three corridors in Haiti and the Dominican Republic specifically fall firmly within the broader geographic 1,600-kilometer Caribbean Biological Corridor, established by these two nations and Cuba to reduce biodiversity

loss and “facilitate the human-nature relationship.” The Caribbean Biological Corridor contains several protected areas and offers important linkages among landscapes, ecosystems, habitats and cultures.

Cockpit Country–North Coast Forest–Black River Great Morass Corridor, Jamaica (North Coast Forest; Cockpit Country; Catadupa; Litchfield Mountain-Matheson's Run; Black River Great Morass key biodiversity areas. Corridor area: 2,458 km^2). Within this corridor, the Cockpit Country Conservation Area comprises the largest contiguous block of wet limestone forest on Jamaica, and includes the upper reaches of five major watersheds. The key biodiversity areas, including the unique dry forests of the North Coast Forest key biodiversity areas, are separated by agricultural areas and roads, with more extensive developments between Cockpit Country and the North Coast Forests. The corridor has been defined to ensure connectivity between the Cockpit Country aquifer and all its rivers down to the coast, and to maintain migration corridors for globally threatened Columbidae between breeding and non-breeding seasons. The key biodiversity areas collectively support populations of 91 globally threatened species, with the North Coast Forest Key Biodiversity Area also supporting a unique, diverse and highly threatened xeric flora that has not been evaluated against the IUCN Red List criteria. The corridor is the source of drinking water for 40 percent of Jamaicans (and controls the flow of water, thus preventing flooding) and there is extensive use of non-timber forest products by local communities within and around the area. The North Coast Forest portion of the corridor is adjacent to and significantly influenced by the country’s major tourist center at Montego Bay.

Portland Bight Protected Area Corridor, Jamaica (Hellshire Hills; Portland Ridge and Bight; Brazilleto Mountains; Milk River key biodiversity areas. Corridor area: 2,622 km^2). Portland Bight Protected Area covers more than 87,000 hectares on the south coast of Jamaica, and embraces populations of 15 globally threatened species. Almost 80 percent of protected area is deforested or developed, yet the key biodiversity areas within this corridor are critically important for their unique biodiversity, and Portland Bight supports the largest intact area of mangrove forest in Jamaica. Hellshire Hills Key Biodiversity Area comprises relatively intact forest (the largest area of dry limestone forest in the Caribbean and Central America), while Portland Ridge is 50 percent forested. Connectivity between these unique dry forest areas will be essential for the long-term survival of this ecosystem and its biodiversity, especially in the face of climate change. Management at a landscape level will also be essential in sustaining the livelihoods of people reliant on the rich coastal portions of this corridor (with fisheries, sustained by the extensive mangroves, being particularly economically important for the corridor’s communities). The mangroves and dry forested hills provide significant coastal zone protection for Portmore and a number of smaller communities. However, proposals for development projects to expand the city of Portmore (adjacent to Hellshire Hills Key Biodiversity Area) and to build a hotel complex in Manatee Bay (within Hellshire Hills Key Biodiversity Area) threaten the corridor’s resilience, and also its ability to regulate flooding, erosion and sedimentation of the near-shore marine environment. With a substantial and important coastal portion to this corridor, there are significant opportunities for adaptation to sea-level rise through coastal protection measures.

Surrey County Corridor, Jamaica (Blue Mountains; John Crow Mountains; Rio Grande; Wag Water River; Swift River; Yallahs; Citron Valley; Bull Bay; Rio Pedro key biodiversity areas. Corridor area: 1,985 km^2). Surrey County Corridor covers a large portion of easternmost Jamaica, and supports populations of 60 globally threatened species, eight of which are Critically Endangered (10 Endangered). The corridor ranges from sea-level (e.g. at the coastal wetland Key Biodiversity Area of Yallahs), to 2,256 meters at the top of Blue Mountain peak, embracing habitats ranging from mangroves to tall wet and montane forest. The Blue and John Crow Mountains National Park (two separate key biodiversity areas) is at the center of the corridor,

with the other key biodiversity areas comprising foothills and lowland river systems or wetlands. In combination, the corridor represents the watershed for the entire eastern end of the island, servicing Kingston and Portmore (and the north coast town of Port Antonio) with fresh water, and also providing flood prevention services. The corridor is important for agriculture (especially "Blue Mountain" coffee production), forestry and tourism. Much of the area is protected within the national park (managed effectively by the NGO Jamaica Conservation and Development Trust), and also within forest reserves (with, for example, the Forestry Department managing a dynamic conservation program in the Buff Bay-Pencar part of the corridor). While there are threats to this corridor, including agricultural expansion, development pressures and invasive plant species, it is comparatively well managed and serviced by NGO and government agencies.

Massif – Plaine du Nord Corridor, Haiti (Plaisance; Morne Bailly; La Citadelle, Sans Souci, Ramiers key biodiversity areas. Corridor area: 1,078 km^2). The Massif du Nord is a geological extension of Hispaniola's Cordillera Central. It runs inland of the north-east coast of Haiti, along which there are a number of biologically rich areas including sea-turtle nesting beaches. The Plaine du Nord is one of the most important agricultural areas in Haiti, well known for its citrus, coffee, cocoa and bananas due to high and regular rainfall, and the remaining canopy trees. Rising from this coastal plain are karst limestone hills and outcroppings, some of which still support xerophytic broadleaf forest and wet broadleaf forest at higher elevations. These patches of forest (represented by the three key biodiversity areas) are poorly known, but support remnants of a unique assemblage of species including 11 globally threatened species. The integrity and long-term viability of these key biodiversity areas need to be ensured by increasing the biological connectivity between these areas and through the agricultural landscapes. This corridor lies within the broad geographic concept of the Caribbean Biological Corridor, but has yet to receive any major conservation investments. The forests provide significant ecosystem services for the downstream agricultural communities, both in terms of forest products and freshwater provision and landslide/ flood prevention. However, these services could be improved through forest restoration and reforestation initiatives.

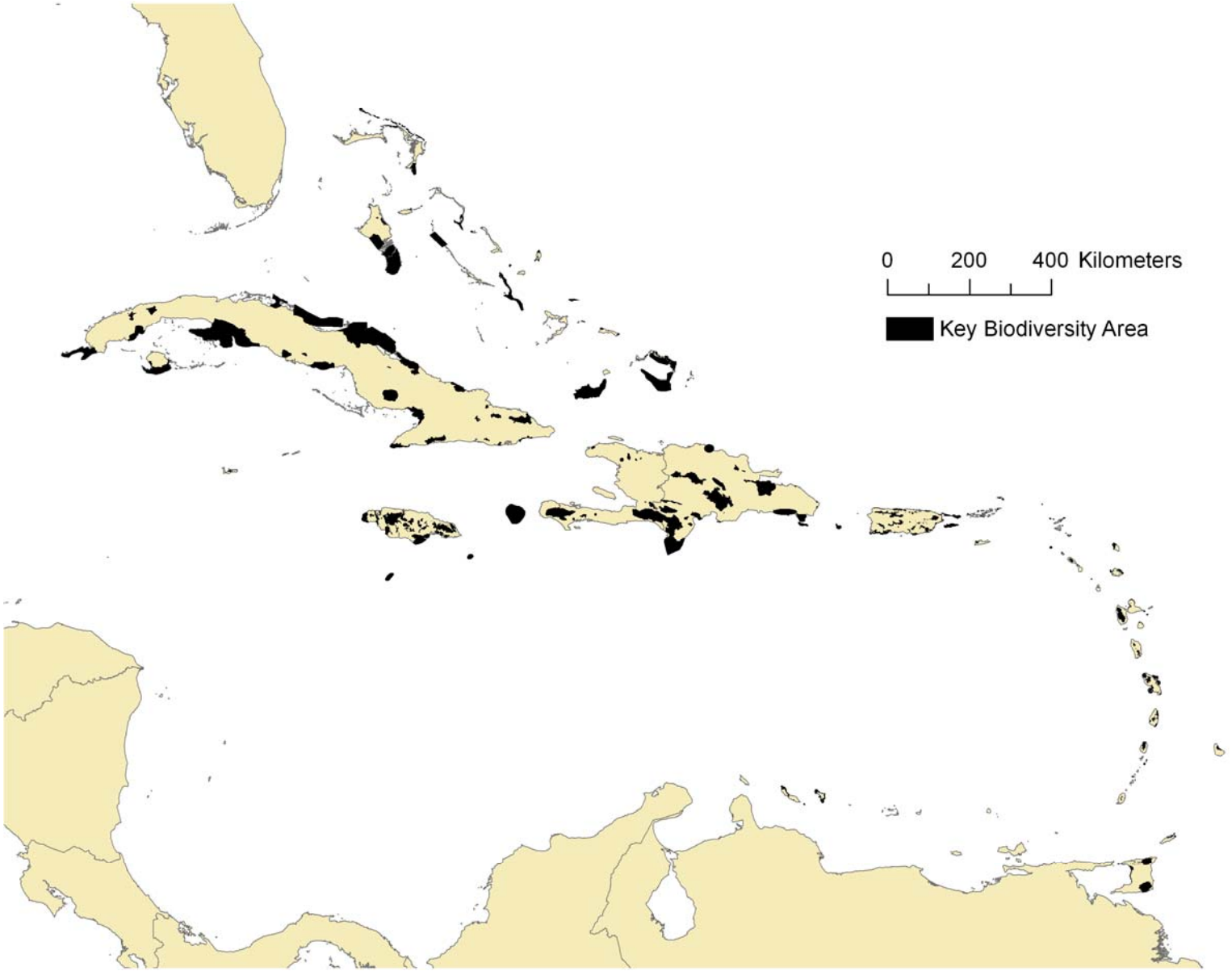
Massif de la Selle – Jaragua–Bahoruco–Enriquillo Binational Corridor, Haiti/ Dominican Republic (Massif de la Selle, Haiti; Lago Enriquillo, Dominican Republic; Sierra de Bahoruco, Dominican Republic; Parque Nacional Jaragua, Dominican Republic key biodiversity areas. Corridor area: 9,324 km^2). The Massif de la Selle in Haiti connects to the Sierra Bahoruco in the Dominican Republic. The mountainous Sierra Bahoruco is connected ecologically with the lowland Jaragua National Park on the Barahona Peninsula (the southernmost part of Hispaniola). Bahoruco and Jaragua are core zones, along with Lago Enriquillo, within the recently designated Jaragua-Bahoruco-Enriquillo Biosphere Reserve. In combination, these areas support the full range of Caribbean ecosystems and populations of 50 globally threatened species. There are critical opportunities for enhancing ecological integrity and ecosystem resilience, improving livelihoods and watershed protection that need to be nurtured to maintain this unique part of Hispaniola. This corridor lies within the broad geographic Caribbean Biological Corridor. It maintains the full altitudinal corridor from sea level to 2,300 meters; represents an important source of drinking water for the surrounding communities (including Port-au-Prince); provides flood and landslide regulatory services; and is an important source of non-timber forest products.

Cordillera Central Corridor, Dominican Republic (Parque Nacional Armando Bermúdez; Loma Nalga de Maco y Río Limpio; Parque Nacional José del Carmen Ramírez; Loma La Humeadora; Valle Nuevo; Ébano Verde key biodiversity areas. Corridor area: 6,517 km^2). The Cordillera Central is the largest mountain range in Hispaniola and includes the highest peak in the Caribbean (at 3,098 meters). Six important key biodiversity areas are embraced by this Conservation Corridor which supports populations of 37 globally threatened species. Outside of these "core"

areas of pine, broad leaf, elfin and cloud forest is a mosaic of agricultural lands, cattle grazing and rural developments. The most important rivers (and water supplies) in the country originate within the forests of this corridor which needs to be managed at a landscape level to preserve the various watersheds, to increase connectivity between forested areas and to improve the ecosystem's resilience to climate change. This corridor lies within the broad geographic concept of the Caribbean Biological Corridor. It maintains an altitudinal corridor from 500 to 3,000 meters; represents an important source of drinking water for a significant percentage of the national population (including for Santo Domingo); provides flood and landslide regulatory services; and is an important source of non-timber forest products.

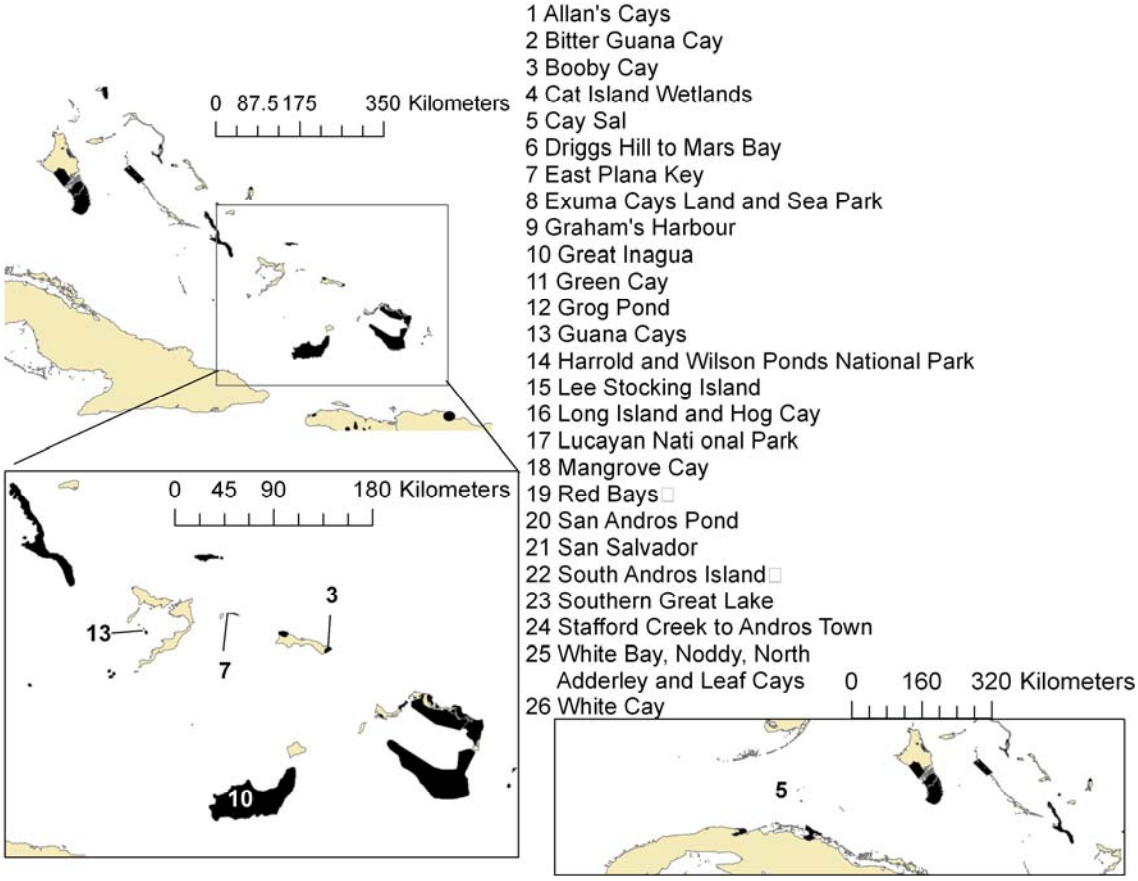
Central Mountain Range Corridor, St. Vincent (Colonarie Forest Reserve; Cumberland Forest Reserve; Dalaway Forest Reserve; Kingstown Forest Reserve; La Soufrière National Park; Mount Pleasant Forest Reserve; Richmond Forest Reserve key biodiversity areas. Corridor area: 132 km^2). The island of St. Vincent is divided north to south by a volcanic central mountain range. The mountain range starts in the north with La Soufriere (1,234 meters)—an active volcano and the island's highest point. Seven key biodiversity areas are contiguous with each other along the forested Central Mountain Range, and collectively they form the proposed Central Forest Reserve under the System of Protected Areas and Heritage Sites (SPAHS). This corridor supports populations of four globally threatened species and embraces the watersheds that provide all of St. Vincent's freshwater. Until the SPAHS program is implemented, the key biodiversity areas in this corridor comprise a disjointed set of variously protected and unprotected forest areas that are being degraded and threatened by agricultural expansion and infrastructure developments. The forests of the Central Mountain Range Corridor represent one of the largest remaining tracts of wet forest in the Lesser Antilles, and one of the few that maintains the full altitudinal corridor from sea level to 1,200 meters.

Figure 2. Map of Site Outcomes for the Caribbean Islands Hotspot

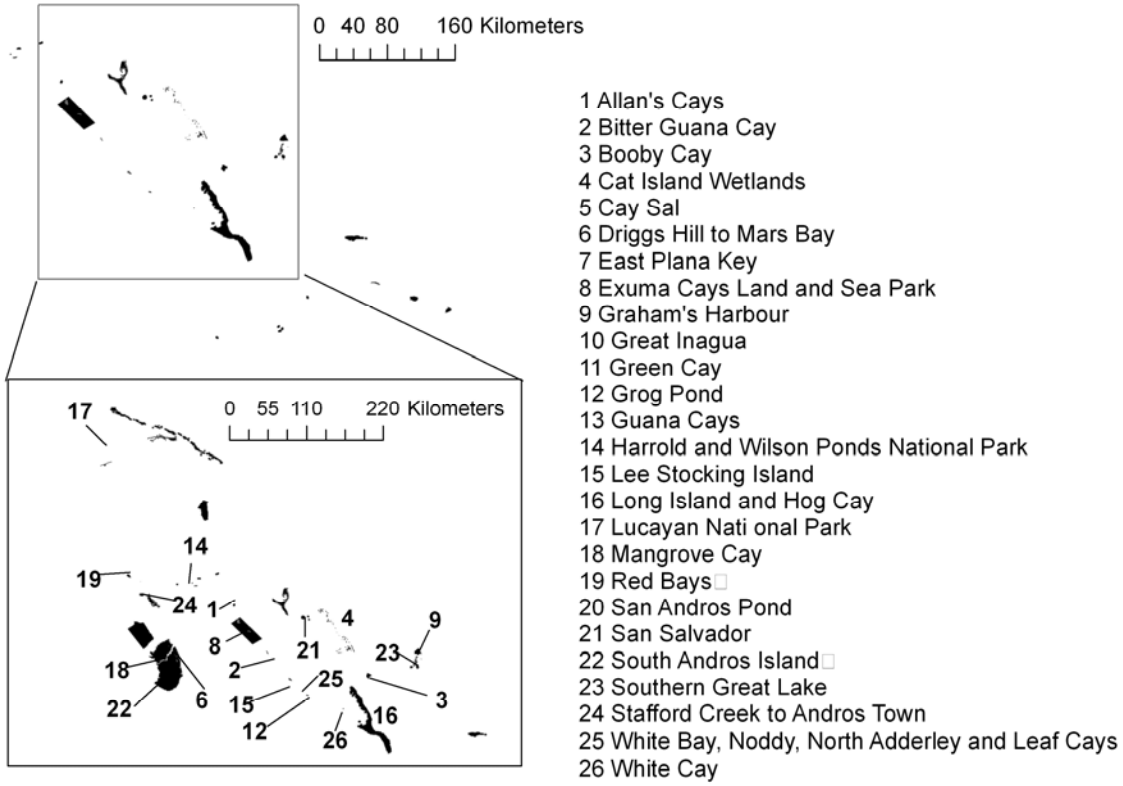


Figures 3-13. Maps of Site and Corridor Outcomes for the Caribbean Islands Hotspot

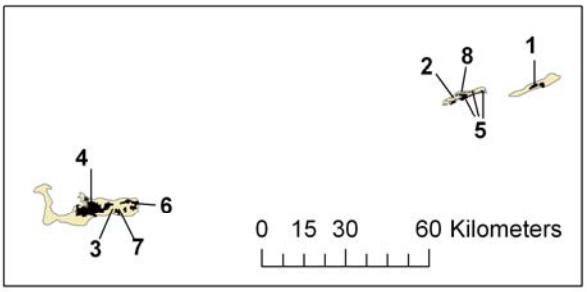
Southern Bahamas: Key Biodiversity Areas



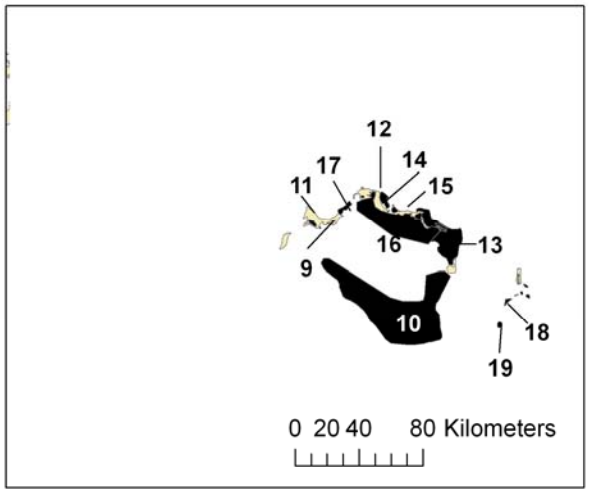
Northern Bahamas: Key Biodiversity Areas



Cayman Islands and Turks and Caicos Islands: Key Biodiversity Areas



CAYMAN ISLANDS
1 Bluff Forest
2 Booby Pond Nature Reserve
3 Botanic Park and Salina Reserve
4 Central Mangrove Wetland
5 Crown Wetlands
6 Eastern Dry Forest
7 Franklin's Forest
8 Sparrowhawk Hill



TURKS AND CAICOS ISLANDS
9 Bay and Middle Cays
10 Caicos Bank Southern Cays
11 Chalk Sound
12 East Bay Islands
13 East Caicos and adjacent areas
14 Fish Ponds and Crossing Place Trail, Middle Caicos
15 Middle Caicos Forest
16 North, Middle and East Caicos Ramsar Site
17 Princess Alexandra Land and Sea
18 Salt Cay Creek and Salinas
19 Turks Bank Seabird Cays

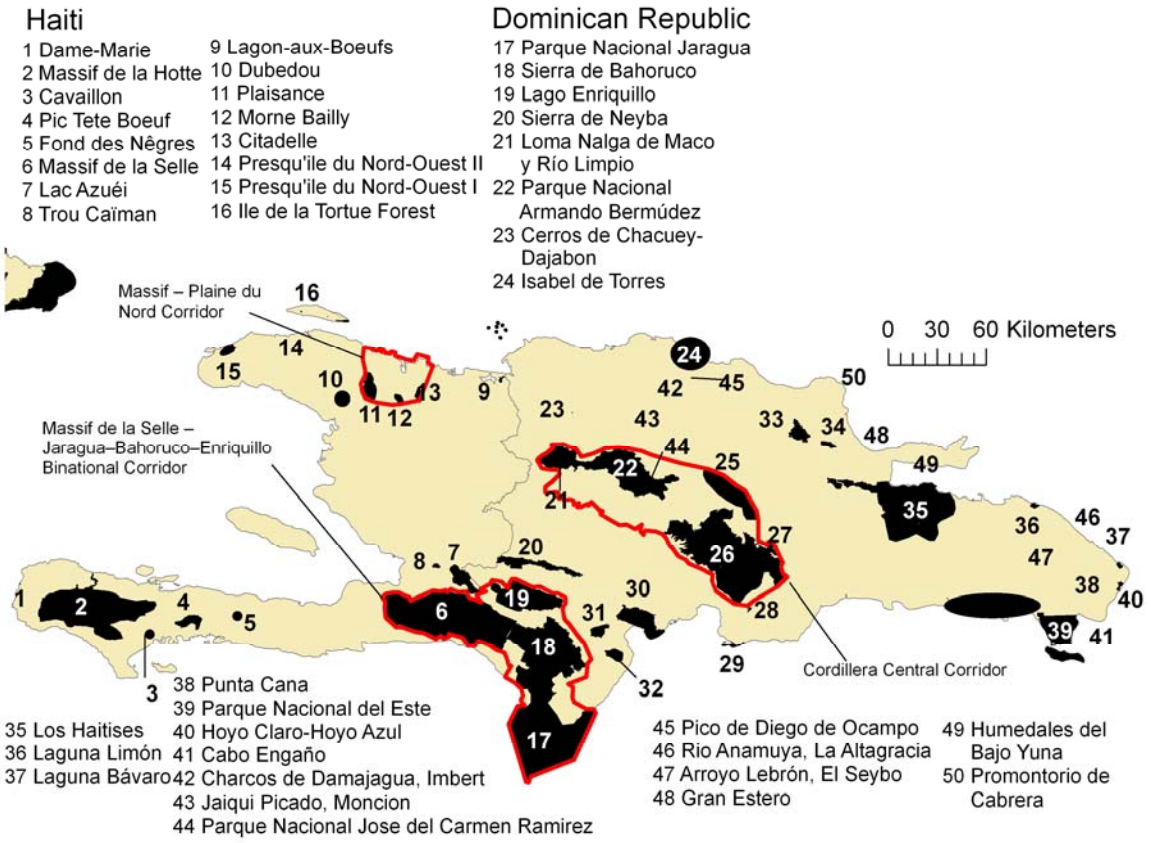
Cuba: Key Biodiversity Areas



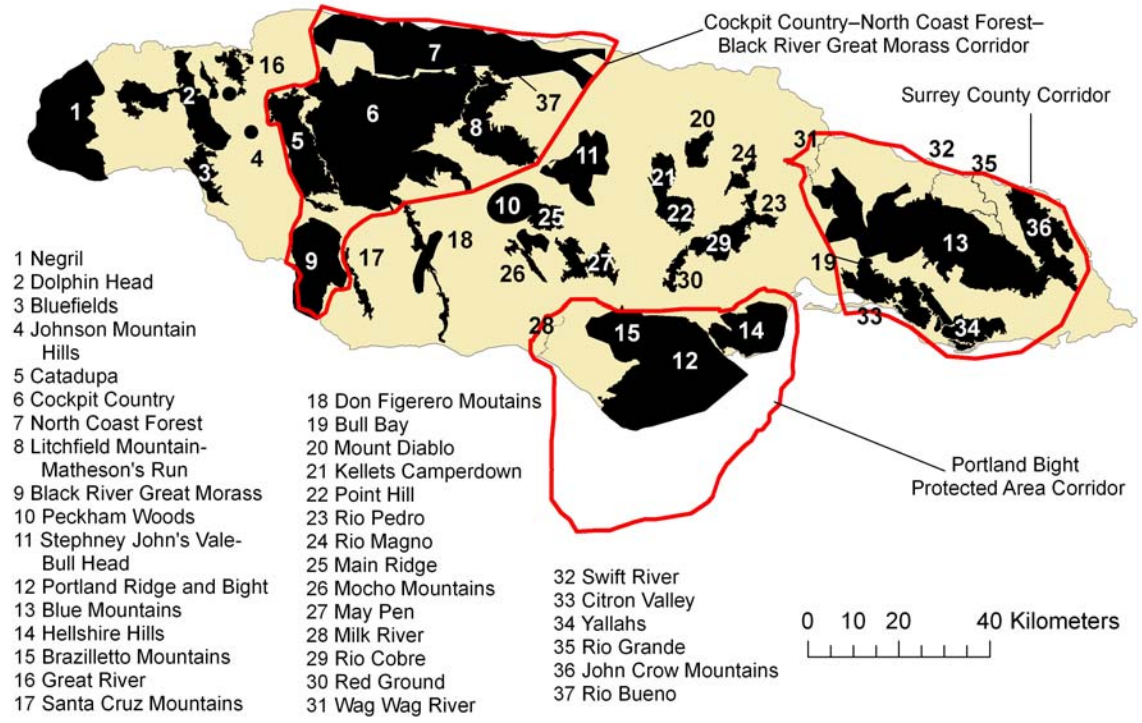
1 Mil Cumbres
2 Rosario Mountain Range
3 Las Picuas-Del Cristo Cay
4 Cayería Centro-Oriental de Villa Clara
5 Gran Humedal del Norte de Ciego de Ávila
6 Cayos Romano-Cruz-Megano Grande
7 Limones-Tuabaquey
8 Río Máximo
9 Cayo Sabinal, Ballenatos y Manglares de la Bahía de Nuevitas
10 Gibara
11 La Mensura
12 Delta del Mayarí
13 Pico Cristal
14 Alejandro de Humboldt
15 Hatibonico - Baitiquirí - Imías
16 Gran Piedra - Pico Mogote
17 Siboney - Juticí
18 Turquino-Bayamesa
19 Desembarco del Granma
20 Delta del Cauto
21 Sierra del Chorrillo
22 Humedal Sur de Sancti Spiritus
23 Alturas de Banao
24 Topes de Collantes
25 Ciénaga de Zapata
26 Cienaga de Lanier y Sur de la Isla de la Juventud
27 Pinar del Rio Southern Wetland
28 Guanahacabibes

Note: Site outcomes for Cuba include only IBAs as it was not possible to incorporate the results of analysis of other taxonomic groups and consultations with experts for other site outcomes at this time.

Haiti and Dominican Republic: Key Biodiversity Areas and Corridors

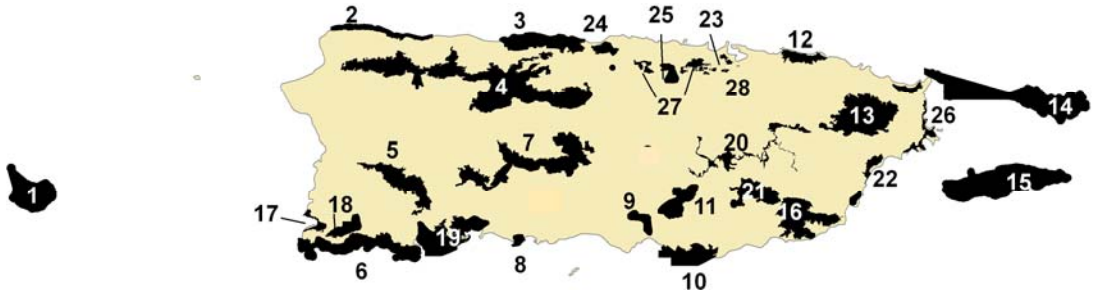


Jamaica: Key Biodiversity Areas and Corridors



Puerto Rico: Key Biodiversity Areas

1 Mona y Monito
2 Acantilados del Noroeste
3 Caño Tiburones
4 Karso del Norte
5 Maricao y Susúa
6 Suroeste
7 Cordillera Central
8 Salinas de Punta Cucharas
9 Baños de Coamo
10 Bahía de Jobos
11 Las Piedras Chiquitas
12 Piñones
13 El Yunque
14 Culebra
15 Vieques
16 Sierra de Pandura
17 Guaniquilla y Boquerón
18 Sierra Bermeja y Laguna Cartagena
19 Karso del Sur
20 Corredor Ecológico del Noreste
21 Carite
22 Humacao
23 Ciénaga Las Cucharillas
24 Laguna Tortuguero
25 Bosque de Vega
26 Ceiba y Naguabo
27 Mogotes del Norte
28 Sabana Seca



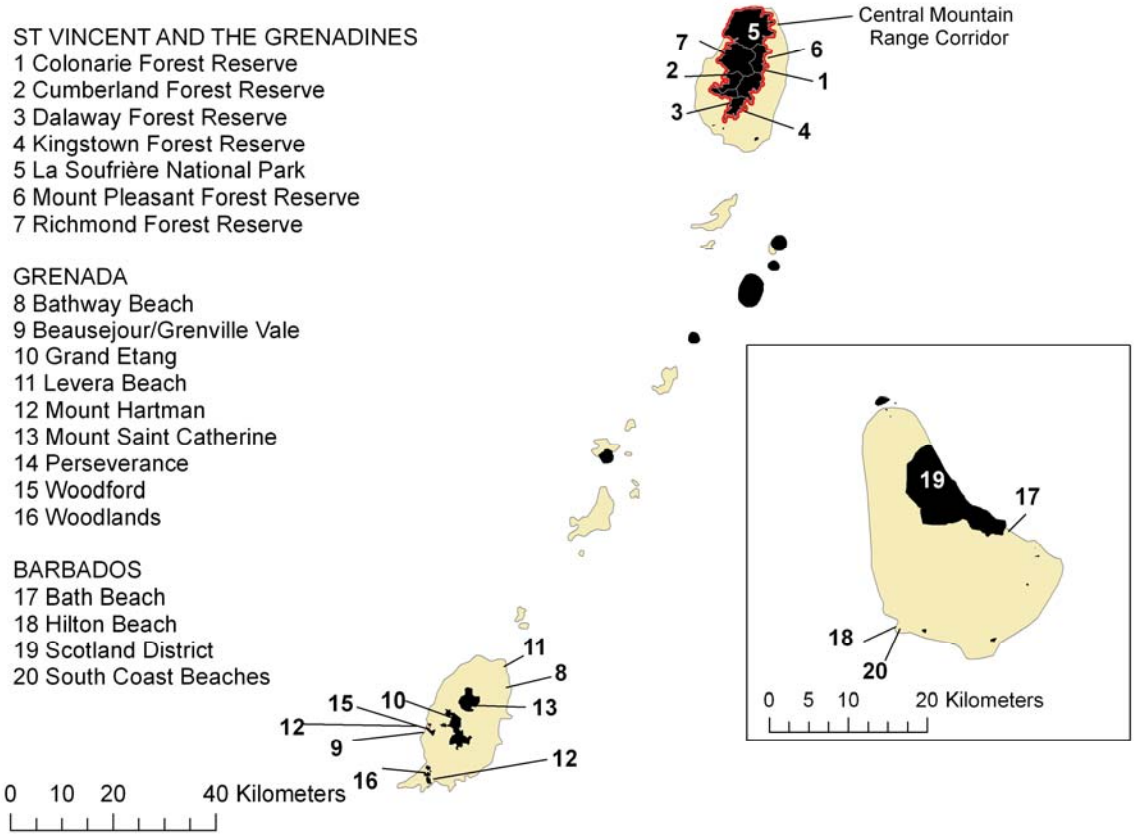
0 10 20 40 Kilometers

Southern Lesser Antilles: Key Biodiversity Areas

ST VINCENT AND THE GRENADINES
1 Colonarie Forest Reserve
2 Cumberland Forest Reserve
3 Dalaway Forest Reserve
4 Kingstown Forest Reserve
5 La Soufrière National Park
6 Mount Pleasant Forest Reserve
7 Richmond Forest Reserve

GRENADA
8 Bathway Beach
9 Beausejour/Grenville Vale
10 Grand Etang
11 Levera Beach
12 Mount Hartman
13 Mount Saint Catherine
14 Perseverance
15 Woodford
16 Woodlands

BARBADOS
17 Bath Beach
18 Hilton Beach
19 Scotland District
20 South Coast Beaches

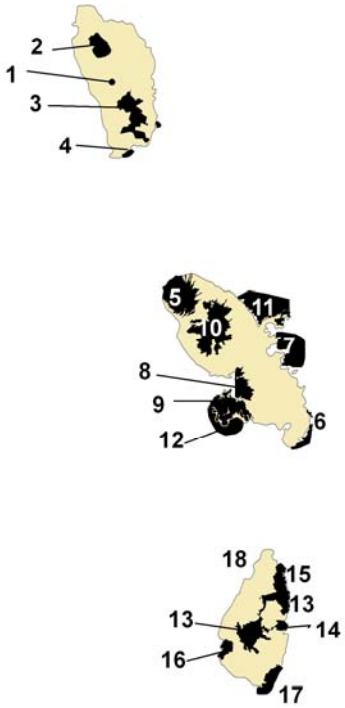


Central Lesser Antilles: Key Biodiversity Areas

DOMINICA
1 Cochrane
2 Morne Diablotin National Park
3 Morne Trois Pitons National Park
4 Point Des Foux

MARTINIQUE
5 Forêts du Nord et de la Montagne Pelée
6 Grand Macabou
7 Ilets Boiseau et Petit Piton
8 Mangrove de Fort de France
9 Massif forestier entre Le Diamant et les Trois-Îlets
10 Pitons du Carbet
11 Presqu'île de la Caravelle
12 Rocher du Diamant

ST LUCIA
13 Government Forest Reserve
14 Mandele Dry Forest
15 North-east coast
16 Pitons Management Area
17 Point Sables
18 Rat Island



0 15 30 60 Kilometers

Northern Lesser Antilles: Key Biodiversity Areas

ANTIGUA
AND BARBUDA
15 Offshore Islands
16 Christian Cove
17 Wallings Forest
18 Potsworks dam
19 Fitches Creek Bay
20 McKinnons
Salt Pond
21 Codrington Lagoon
and the Creek
22 Hanson's Bay - Flashes
23 Wallings Forest
24 Valley Church Bay

MONTSERRAT
25 Centre Hills
26 Northern Forested Ghauts
27 South Soufriere Hills

GUADELOUPE
28 îlets de la Petite-Terre
29 Falaises Nord et Îlet de Vieux-Fort
de Marie-Galante
30 Gallery Forest of Baie-Mahault
31 Grand Cul-de-Sac Marin's eastern coastline
32 La Désirade
33 Massif forestier de l'île de Basse-Terre
34 Pointe des Châteaux
35 Trois-Ilets & Folle Anse de Marie-Galante

SINT EUSTATIUS
36 Boven
37 The Quill

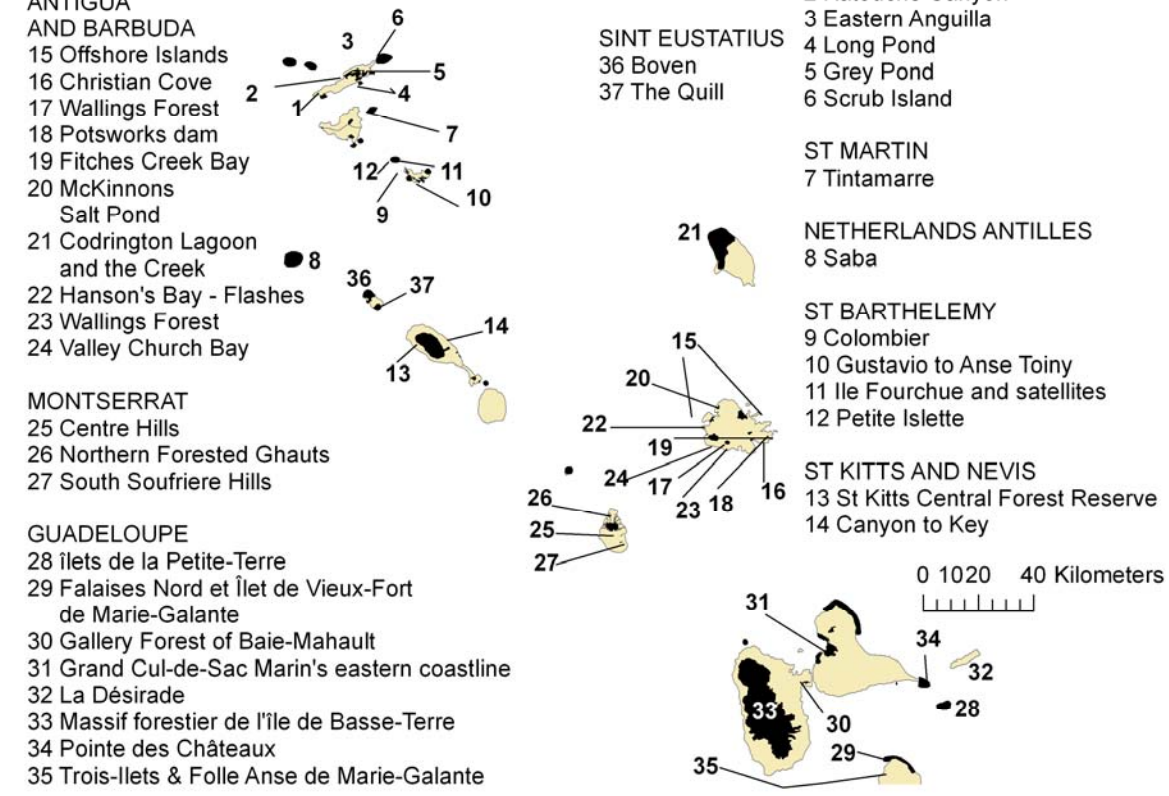
ANGUILLA
1 Cove Pond
2 Katouche Canyon
3 Eastern Anguilla
4 Long Pond
5 Grey Pond
6 Scrub Island

ST MARTIN
7 Tintamarre

NETHERLANDS ANTILLES
8 Saba

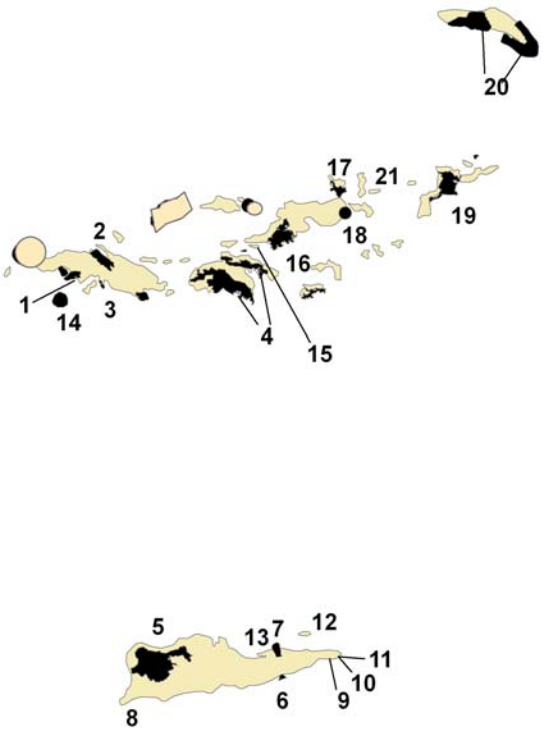
ST BARTHELEMY
9 Colombier
10 Gustavio to Anse Toiny
11 Ile Fourchue and satellites
12 Petite Islette

ST KITTS AND NEVIS
13 St Kitts Central Forest Reserve
14 Canyon to Key



0 1020 40 Kilometers

U.S. Virgin Islands, Netherlands Antilles and British Virgin Islands



U.S. VIRGIN ISLANDS
1 John Brewer's Bay
2 Magens Bay
3 Hassel Island
4 St John
5 Northwestern St Croix
6 Ruth Cay
7 Southgate and Green Cay
8 Sandy Point National Wildlife Refuge
9 Jack's Bay
10 Issac's Bay
11 East End Bay
12 Buck Island
13 Protestant Cay

NETHERLANDS ANTILLES
14 Saba

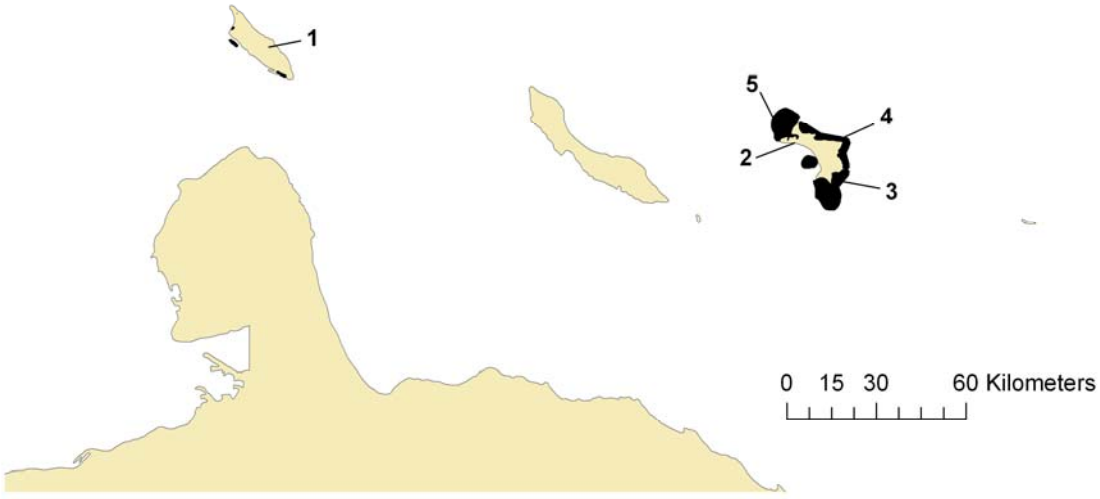
BRITISH VIRGIN ISLANDS
15 Little Thatch Island
16 Sage Mountain Area
17 Guana Island
18 Anegada
19 Virgin Gorda
20 Anegada: Western salt ponds and coastal areas
21 Necker Island

0 10 20 Kilometers

Southern Netherlands Antilles: Key Biodiversity Areas

ARUBA
1 Arikok National Park

BONAIRE
2 Dos Pos
3 Lac Bay
4 Washikemba-Fontein-Onima
5 Washington-Slagbaai National Park



SOCIOECONOMIC, POLICY AND CIVIL SOCIETY CONTEXT OF THE CARIBBEAN ISLANDS

The Caribbean Islands have a high cultural, political, economic and social diversity, but share commonalities in terms of their history (European colonization, dominance of the plantation system), culture (Creole societies built on the early elimination of indigenous societies, importation of slave labor and blending of traditions originating from various continents) and ethnic compositions (high diversity, relatively small indigenous Amerindian populations and large numbers of people of African descent) (Brown *et al*. 2007).

Human Demography and Impact on Environment

Historical Context

There had been several waves of human colonization of the Caribbean prior to its "discovery" by the Europeans, with the earliest archaeological evidence dating back to 6,000-7,000 BP (Fitzpatrick and Keegan 2007). Three main groups were present before the European arrival—the Ciboney people, restricted to parts of Cuba; the Arawak (Taino or Lucayan) people across the Greater Antilles and the Bahamas; and the Carib people in the Lesser Antilles. The arrival of Europeans led to the disappearance of these groups from most islands within one or two generations, and the islands are now a complex mosaic of cultures and ethnic groups combining indigenous American, Hispanic, African, Anglo-Saxon, French and Asian cultures. Settlement histories on the islands are complex and often very different even within the same country.

The initial Amerindian peoples of the Caribbean had little negative impact on the environment in terms of habitat destruction but they did introduce alien species of plants and animals, primarily from South America, that have since become integral parts of Caribbean ecosystems. This "creolization" of the flora and fauna was accelerated by the Europeans with further species introduced from South and Central America, Africa, Asia, Europe and the Pacific, leading to a radical transformation of the natural environment and destruction of natural ecosystems, primarily to accommodate the establishment of the plantation system based on slave labor and geared toward export markets.

Demographic Trends

Prior to the arrival of Europeans, the human population of the Caribbean is estimated to have been 750,000. The regional population grew (after the decimation of its indigenous peoples) to 2.2 million in 1800, but in the following 200 years it increased enormously to its current level of around 38.4 million. The most populated islands are Cuba (11.2 million), the Dominican Republic (9.6 million) and Haiti (8.3 million) but the highest population densities occur on Barbados, Puerto Rico and Aruba. Populations on many of the smaller islands, e.g. St. Maarten, Cayman Islands, Aruba, the Bahamas and Barbados change enormously during the year due to the seasonal influx of tourists (for instance, total tourist arrivals in the Cayman Islands exceeded 2.1 million in 2003, but the resident population only numbers around 56,000). Populations have increased significantly in the last 40 years in most countries, particularly Cuba, Haiti, Dominican Republic and Puerto Rico (ECLAC 2007, ECLAC 2009a), but the rate of growth has slowed (annual average population growth in 2003 was 0.82 percent for 12 islands in the Caribbean Islands Hotspot compared to 1.45 percent in 1970 (Heilemann 2005)), and some countries, such as Montserrat and St. Kitts and Nevis, are less populated today than in 1970. The population of the region is predicted to increase slightly by 2050, although there are large differences between countries with some expected to increase substantially, such as Haiti (8.3 million in mid-2008 to 15.1 million in 2050) and Dominican Republic (9.6 million in mid-2008 to 14 million in 2050),

while others such as Cuba (11.2 million in mid-2008 to 9.9 million in 2050) are predicted to fall (Population Reference Bureau 2008).

The majority of people in the Caribbean live in urban areas close to the coast. Urbanization has been rapid and largely unplanned and has increased significantly over the past 40 years on all of the islands and is approximately 10 percent above the average for Latin America and the Caribbean as a whole (Heileman, 2005). In 2005, 64 percent of the population of the Caribbean Community (CARICOM) countries was classified as urban and this is expected to reach 71 percent or 10.5 million persons in 2020 (*Nature and the Economy: Addressing the delicate balance*; Presentation by Dr. Compton Bourne, president, Caribbean Development Bank, 2007). In the poorer countries, uncontrolled and squatter settlements have expanded considerably, especially in coastal areas. Unfortunately, provision of sanitation services has not kept pace with the growing urban population, and lack of access of improved sanitation is particularly high in Haiti. Much of the untreated sewage and solid waste ends up being dumped into the environment generating a major pollution threat to biodiversity.

These population processes—high historical growth rate with high population densities, massive seasonal influxes and increasing urbanization of the population—have led to unsustainable demand for land and natural resources to the detriment of the hotspot's biodiversity and ecosystems (Heilemann 2005).

Political and Economic issues

Political Systems

There is a wide variation in political systems among the islands of the Caribbean, which is partly a reflection of former or current colonial affiliations. These include a revolutionary government in Cuba, parliamentary democracies modeled on the British system in most of the Commonwealth Caribbean, a form of presidential system in the Dominican Republic and an emerging democracy in Haiti. Among the dependent territories, Martinique and Guadeloupe are départements d'outre-mer (overseas departments) of France (and outermost regions of the European Union) and elect members to the national assembly in Paris, whereas the British, Dutch and U.S. territories have locally elected national governments. Different groupings of islands are linked through their membership of various inter-governmental associations and mechanisms (see Table 6).

The formal regional mechanism with the broadest membership is the Association of Caribbean States (ACS), based in Trinidad and Tobago, which includes all countries around the Caribbean Basin except the USA. ACS focuses on four areas: trade, transportation, tourism and natural resources. Its objectives are stated as "the strengthening of the regional co-operation and integration process, with a view to creating an enhanced economic space in the region; preserving the environmental integrity of the Caribbean Sea which is regarded as the common patrimony of the peoples of the region; and promoting the sustainable development of the Greater Caribbean."

The Caribbean Community (CARICOM), with a secretariat in Guyana, is the other major intergovernmental grouping. Its membership includes the countries of the Commonwealth Caribbean, plus Suriname and Haiti. Moves toward regional integration within CARICOM have recently been strengthened with the establishment of the Caribbean Single Market and Economy (CSME) and the Caribbean Court of Justice. The CSME provides for the free movement of people, goods, services and capital, and will lead to harmonized laws and social, economic, environmental and trade policies in participating member states. The Organisation of Eastern Caribbean States (OECS), with its headquarters in St. Lucia, is a sub-regional grouping

comprised of Anguilla, Antigua and Barbuda, the British Virgin Islands, Dominica, Grenada, Montserrat, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines. It facilitates regional cooperation in a number of sectors, including education, environment, health and sports, and is in the process of establishing an Economic Union that makes provisions for common legislation across member states. It is anticipated that environmental legislation is the first area in which member states will move on this front. While the dependent territories of the eastern Caribbean are members of OECS, most are not members of CARICOM or ACS, but are part of the Caribbean Development and Cooperation Committee of the United Nations Economic Commission for Latin America and the Caribbean (UN-ECLAC).

Table 6. National Membership of Regional Caribbean Political Groupings

	Grouping			
Country	**ACS**	**CARICOM**	**UN-ECLAC**	**OECS**
Anguilla		A	A	A
Antigua and Barbuda	F	F	F	F
Aruba	A		A	
Bahamas	F	F	F	
Barbados	F	F	F	
British Virgin Islands		A	A	A
Cayman Islands		A		
Cuba	F		F	
Dominica	F	F	F	F
Dominican Republic	F	Observer	F	
France (islands)	A		F	
Grenada	F	F	F	F
Haiti	F	F	F	
Jamaica	F	F	F	
Montserrat		F	A	F
Netherlands Antilles	A		A	
Puerto Rico			A	
St. Kitts and Nevis	F	F	F	F
St. Lucia	F	F	F	F
St. Vincent and the Grenadines	F	F	F	F
Turks and Caicos Islands	A	A	A	
U.S. Virgin Islands			A	

F = Full member
A = Associate member

Economic Issues and Key Sectors with Impact on Terrestrial Biodiversity

Over the last 20 years, tourism (with associated construction and services industries) has become the primary economic activity in the majority of the Caribbean Islands Hotspot, and drives much of the commodity trade in the region. There has also been significant development of offshore financial centers offering attractive tax arrangements (such as on Aruba and the Cayman Islands; how this industry will be affected by proposed changes to international banking and finance

following the financial crisis of 2008-2009 is unclear but likely to impact negatively in the Caribbean), and mining makes an important contribution to some national economies, such as in Cuba and Jamaica. Agriculture, traditionally the most important sector for growth, has remained stagnant or contracted in many countries. Most of these sectors have a substantial impact or are dependent on the environment.

Agriculture

In 2005, 32.7 percent of the land in the Caribbean small island developing states (SIDS) was classified as agricultural area (total area under arable land and permanent crops), although the figures vary considerably at the national level, from almost 40 percent on Barbados, Cuba and Haiti, to nearly zero on some of the smaller islands such as Anguilla, Turks and Caicos, and the U.S. Virgin Islands (UNEP GEO LAC Data Portal). Common agricultural products from the region are bananas (many islands), sugar (especially Barbados, Jamaica, St. Kitts and Nevis), coffee (Haiti, Dominican Republic, Jamaica, Cuba and Puerto Rico), cotton (Antigua) cocoa (Grenada and Dominican Republic) and citrus fruits and pimento.

In many countries, the percentage of agricultural land has decreased between 1970 and 2005, particularly in Grenada, Guadeloupe, Puerto Rico and St. Kitts and Nevis, but has increased in other such as Dominica, the Dominican Republic, British Virgin Islands, and especially in Cuba (by 15.7 percent over this period). Similarly, total and per capita agricultural production has decreased in most of the Caribbean countries and territories. In part, this has been due to the loss of preferential markets especially for sugar, bananas and rum, although the agricultural sector continues to be important in many countries and plays a significant social role (ECDPM 2006). For instance, the Windward Islands (the southern Lesser Antilles, from Martinique south) are still heavily dependent on a limited number of agricultural commodities for their export earnings and employment and some 20 percent of the workforce on Dominica for instance is employed in the agricultural sector. Food security has become complicated by increases in world food prices in the last few years. As a result, the cost of some agricultural imports has risen (the Caribbean is a net importer of most basic grains, pulses and oil seeds, including the ones experiencing continuous and significant price increases, e.g. wheat), which is forcing governments to reevaluate their agricultural policies. The negative impact of higher food prices could eventually translate into a severe setback in the regional achievements in poverty reduction and social development, and increase pressure on Caribbean biodiversity and ecosystems. It also places greater importance on the need to maintain ecosystem services, which are most important to the poorer sections of society.

There have been a number of alternative initiatives aimed at both broadening opportunities for sustainable rural livelihoods and diversifying agricultural products that may also benefit biodiversity and ecosystem services. These include promotion of organic farming (particularly for the smaller islands as organic farming has the advantage of being amenable to small scale production; see www.organicinitiativecaribbean.org), the use of ethno-botanical products for the herbal and cosmetic markets, and the strengthening of linkages between agriculture and tourism including through food festivals (e.g. yam festivals in Jamaica) and promotion of "eco-agritourism." The Fair Trade System (http://www.fairtrade.org.uk/) has been established within the banana industry in the region, which aims to have positive effect on the environment (e.g. protection of ecosystems of high ecological value and the protection of water sources from chemical pollution). On Jamaica, the Ministry of Agriculture has supported the development of the local organic agriculture sector through an investment of $20 million in the National Organic Agriculture Enhancement Project (NOAEP, see www.jamaica-gleaner.com/gleaner/20060907/farm/farm3.html). However, successes need to be better promoted and systems established to enable greater uptake of such initiatives (e.g. improved access to

micro-credit, technical training, etc.).

Forestry

The forestry sector in the insular Caribbean is small (although can be locally important), a reflection of the relatively small forest coverage, and most islands are heavily dependent on imports to meet their paper, sawn wood and wood-based panel requirements. The proportion of forest land on the larger islands ranges from 3.8 percent on Haiti to 46 percent on Puerto Rico in the Greater Antilles and from 1.5 percent in the Netherlands Antilles to around 61.3 percent in Dominica in the eastern Caribbean (see Table 7), and overall, 25.7 percent of the land area of the Caribbean islands is classified as forest lands (FAO 2006a, FAO 2009). Cuba and St. Vincent and the Grenadines are the only two countries in the region that have managed to significantly increase their forest cover between 1990-2000 and 2000-2005 (by 1.7 percent and 2.2 percent in Cuba and 0.8 percent and 0.8 percent in St. Vincent and the Grenadines respectively) (FAO 2006a, FAO 2009). Wood charcoal production is also high in Cuba (61,200 tonnes in 2004) and the Dominican Republic (14,000 tonnes in 2005) but also in Haiti (estimated 28,000 tonnes) (data from http://faostat.fao.org/ accessed 27/5/2009), which has the greatest extent of deforestation in the region.

Table 7. Forest Cover and Forest Loss in the Insular Caribbean

Country/ Territory	Total forest cover (1,000 ha) in 2005	Forest as % land cover	Total change 1990-2005 (1,000 ha)	Total change (%) 2000-2005
Anguilla	6	71.4	0	0
Antigua and Barbuda	9	21.4	0	0
Aruba	0	2.2	0	0
Bahamas	515	51.5	0	0
Barbados	2	4.0	0	0
Cayman Islands	12	48.4	0	0
Cuba	2,713	24.7	655	31.8
Dominica	46	61.3	-4	-8.0
Dominica Republic	1,376	28.4	0	0
Grenada	4	12.2	0	0
Guadeloupe	80	47.2	-4	-4.8
Haiti	105	3.8	-11	-9.5
Jamaica	339	31.3	-6	-1.7
Martinique	46	43.9	0	0
Montserrat	4	35.0	0	0
Netherlands Antilles	1	1.5	0	0
Puerto Rico	408	46.0	4	1.0
St. Kitts and Nevis	5	14.7	0	0
St. Lucia	17	27.9	0	0
St. Vincent and the Grenadines	11	27.4	2	22.2
Turks and Caicos	34	80.0	0	0
Virgin Islands (British)	4	24.4	0	0
Virgin Islands (U.S.)	10	27.9	-2	-16.7
Total	**5,747**	**25.7**	**634**	

From FAO (2006a, FAO 2009)

While the future of forests in the region is not promising as existing pressures on this resource are expected to increase, some encouraging results have emerged from localized forest conservation and reforestation efforts, and investment in innovative and alternative models of sustainable management of forest resources (timber and non-timber) need to be encouraged.

Tourism

The tourism industry in the Caribbean islands has developed rapidly over the last 40 years, initially driven by post-independence economic restructuring throughout the region largely due to declining competitiveness in the agricultural sector. Since the 1960s, tourism has become the leading economic sector in many island states, the fastest growing economic sector in the sub-region (CARICOM Secretariat 2003), and, in terms of growth and contribution to GDP, tourism development can be viewed as a great success for the region.

The islands in the Caribbean Islands Hotspot hosted 15.23 million visitors in 2005, the most recent year for which there are complete statistics (CTO 2008, not including cruise ship visits), with the Bahamas, Cuba, Dominican Republic, Jamaica and Puerto Rico each receiving more than 1 million visitors. There were also 12.5 million cruise ship passenger visits to the islands in 2004, and the Caribbean hosts approximately 50 percent of the berths of the world's cruise tourism. According to the World Travel and Tourism Council (WTTC 2004), travel and tourism demand in the Caribbean region (including the 32 member countries/territories of the Caribbean Tourism Organization excluding Mexico) amounted to $40.3 billion in 2004, and is expected to rise to $81.9 billion by 2014. Tourism is particularly important economically for some of the smaller Caribbean countries. In Anguilla, Antigua and Barbuda, and the British Virgin Islands, for instance, the travel and tourism sector accounted for 71.9 percent, 82.1 percent and 95.2 percent of GDP respectively in 2004 and over 50 percent in Aruba, the Bahamas and Barbados (WTTC 2004). In addition, the tourism industry accounts for more than 65 percent of the labor force on some islands (namely Anguilla, Aruba, Bahamas, Antigua and Barbuda, and British Virgin Islands; the figures being 95 percent for the latter two). The WTTC estimates that the travel and tourism sector will contribute about 14.8 percent to the region's GDP in 2004, the highest tourism GDP dependency in the world (WTTC 2004).

In the insular Caribbean, tourism is dependent on the coastal and marine areas, and the concentration of tourism infrastructure and activities on the coast causes major environmental problems for coastal habitats. The tourism sector is expected to continue to grow in the region (WTTC 2004), which will require further land for construction (hotels, golf courses, marinas) and resources (water, imported and local food, energy, building materials). For instance, the government of the Bahamas' current economic thrust is to put an anchor resort on each of the major Family Islands (the out islands) that will have huge implications for the biodiversity of these otherwise relatively untouched islands. Community-based nature and heritage tourism are being developed in several countries, including Dominica, Jamaica, St. Lucia and Montserrat, which can be of significant economic value (Caribbean islands – especially Jamaica, Barbados and Aruba – are considered to be among the world leaders in sustainable tourism; almost 40 percent of the eco-certificates awarded by Green Globe, for example, have gone to this region.). However, the relatively low levels of investment in these ventures compared with the continued construction of large-scale resorts across the region, the encouragement provided to the cruising industry and recent investments in major yacht facilities in several countries, point to a disconnect between government policy and action.

Mining

Mining is an important source of foreign exchange for some countries (Heileman 2005), especially for Jamaica (bauxite and alumina from the Cockpit Country Corridor), Cuba (cobalt and nickel) and the Dominican Republic (bauxite, cement, ferronickel, gypsum, limestone, marble, nickel, salt, sand and gravel), and is expected to increase in the region. Cuba, for instance, is increasing its exploitation of oil and nickel reserves (*Caribbean Net News*, 21 March 2007). There is also salt mining on Inagua in the Bahamas, which is an important local employer. Concern about the negative impacts of mining activities, particularly open-pit bauxite mining, on human health, communities and the environment is growing.

Energy Production and Distribution

Per capita energy use is generally high in the Caribbean, especially in the U.S. Virgin Islands and the Netherlands Antilles. Due to limited development of other sources, 90 percent of all energy utilized in the region is derived from petroleum, most of which is imported at high cost to the countries. Some countries, including the Bahamas, Jamaica, St. Lucia and Grenada are particularly dependent on imported fuel. Due to high prices and limited electricity distribution networks, the more remote and poorer rural communities, tend to be strongly dependent on fuelwood and charcoal for cooking and crop-drying, but over-collecting has led to degradation and loss of forest and scrub areas, and rising energy demand is only likely to increase this.

Faced with high imported energy prices, some countries have begun to invest in renewable energy alternatives such as wind power on Barbados and St. Lucia, hydroelectricity in Dominican Republic (especially within the Cordillera Central Corridor) and Haiti (where it delivers 5 percent of the energy used), and small-scale hydroelectricity in Dominica and St.Vincent (within the Central Mountain Range Corridor). The generation of electricity from ethanol produced from biomass feedstock is also being considered in sugar-producing countries such as Barbados, the Dominican Republic and Jamaica. Bagasse, a byproduct of sugarcane, is already used in electricity generation in Cuba (Heileman 2005). There are also local schemes that use solar energy for domestic and hotel water heating on some islands. CARICOM is currently implementing the 13-country Caribbean Renewable Energy Development Project (CREDP), which aims to “reduce barriers to the increased use of renewable energy thus reducing the dependence on fossil fuels while contributing to the reduction of greenhouse gas emissions.” It is partially funded by GEF. Other key regional energy initiatives include the Task Force on Regional Energy, Brasilia Platform on Renewable Energies (adopted at the Regional Conference for Latin America and the Caribbean in Brasilia, October 2003), and the Caribbean Energy Information System (CEIS).

Most governments have also been actively promoting the efficient use of non-renewable energy sources and some countries have adopted energy saving targets and introduced cleaner energy technologies and demand management programs. However, only a few countries (Barbados, St. Lucia and Cuba) have adopted (or are in the process of adopting) National Energy Policies and Action Plans. Lack of progress in adopting alternative energy sources is attributed to costs (currently higher than traditional sources - few countries have yet to introduce adequate tax and fiscal incentives to promote uptake of such technologies, exceptions being Barbados, St.Lucia and Jamaica), and there is a lack of public information about energy-efficient technologies and renewable energy options that needs to be addressed.

The region has more renewable energy than agricultural resources available and there is concern that increased focus on bio-fuels from agriculture could lead to increased clearance of natural habitat for crops. Instead, greater emphasis needs to be given to pursuing the development and introduction of alternative renewable energy sources.

Fisheries and Aquaculture

It is important to note that fish is the most important source of protein after poultry in the Caribbean, especially in rural areas where the incidence of poverty may be high, and that fish, fish products and other marine biodiversity form an important source of employment and foreign exchange earnings. Unfortunately, increased erosion from poor land management, particularly clearance of forest and overuse of agricultural soils, and pollution from agricultural, urban and land-based commercial/industrial sources is negatively impacting coral reefs, mangroves and seagrass beds which are critical for island fisheries in the region. Similarly, aquaculture on land has been developed on many islands, but has caused serious environmental impacts, such as the clearance of mangroves and other coastal vegetation for ponds, declining water quality caused by nutrient enrichment, oxygen depletion of out-flowing water and escape of invasive species.

Globalization and the Impact of the Global Economic Crisis

As noted above, Caribbean economies are heavily dependent on external trade and the loss of non-reciprocal and preferential trade agreements as part of recent globalization measures has contributed to the decline of the traditional agricultural sector in the region and increased competition in the international marketplace (particularly for bananas, rice, sugar and rum) and the liberalization of domestic markets under globalization has been an area of serious concern among governments (ECLAC 2008). In addition, Caribbean countries have not been immune to the global economic crisis and most have very high levels of public debt (which combined with small taxable populations challenges long-term economic viability), with Barbados, Jamaica, Dominica, Grenada and St. Kitts and Nevis recording public debt above 100 percent of GDP (ECLAC 2009b). Growth forecasts point to a further slowdown of economic activity in the Caribbean, especially because of the region's reliance on trade with countries whose economies are in recession (ECLAC 2009b).

The long-term impacts of globalization and the current economic recession on biodiversity and ecosystems in the region are uncertain, although an expected response is change in government policy to promote greater economic diversification and self-sufficiency in key sectors such as agriculture, energy and tourism and less public-sector funding available for environmental management. Short-term responses have focused on fiscal stimulus, sectoral and social policies, with infrastructure developments to help cushion the fall-out on growth and employment (e.g. the $120 million New Providence Road on the Bahamas and J$2.5 billion earmarked by the Jamaican government for infrastructure, including roads, drains and gullies) which are likely to have negative impacts on the natural environment. In view of these potential impacts there is a clear need for wider uptake of Strategic Environment Assessments, which are not routinely applied in the Caribbean.

Poverty

Based on their gross national income per capita, Caribbean countries are considered middle and high income, except Haiti, which is classified as low income (see Table 8). Similarly, all Caribbean countries fall within the high and medium development categories of the Human Development Index of the United Nations Development Programme (UNDP), except Haiti, where the level of development ranks low (UNDP 2006, 2007). However, there are high levels of economic inequity even in some of the richer countries and poverty is a concern across the region (UNDP 2006, 2007). The percentage of the population below the poverty line (on an average income of <$1 per day) ranges from 12 percent in Antigua and Barbuda to 79 percent in Haiti (World Bank 2005a), which remains the least-developed country in the Americas. Unfortunately, contractions in the traditional agricultural sector have contributed to increasing poverty among rural populations in the eastern Caribbean, and there is also concern about the growth in urban

poverty and its associated social problems of crime and insecurity, the socioeconomic impact of HIV/AIDS (the Caribbean is the region most affected by HIV/AIDS in the Western Hemisphere), and the ageing of populations, and high debt burdens in some countries e.g. Jamaica, have led to restrictions in social sector spending which affects the poor and the marginalized in particular (CANARI 2005, CDB 2007). Poverty affects women more than men in the Caribbean with unequal access to natural, economic and household resources and higher unemployment rates.

The majority of Caribbean countries have maintained a positive trend in key social and health indicators. For example, the average under-five mortality rate per 1,000 live births, which is often used as a surrogate for social state, has been reduced from 39 to 30 (UNDP, 2003) and Caribbean states are at the top of all developing country groups in the world, exceeded only by high-income countries. However, among the Caribbean islands, Haiti still has a high under-five mortality rate (120/1,000 live births in 2005 but down from 221/1,000 in 1970), whereas Cuba has a figure of only 7 in 2005 (down from 43 in 1970), the lowest for the islands for which data are available (UNDP 2007). The Caribbean islands continue to perform well as a whole on education, which is reflected by relatively high public spending on education and lower illiteracy rates than other developing regions. Haiti, however, continues to be an outlier with respect to all social indicators, demonstrating the strong link between economic performance, social-well being and the condition of the environment.

Ecosystem Services and the Relationship between Environment, Development and Poverty

As the Millennium Ecosystem Assessment (Millennium Ecosystem Assessment 2005) showed, biodiversity and ecosystems provide a huge range of essential goods and services to human kind, and without these ecosystem services (the multitude of resources and processes supplied by natural ecosystems from which humans benefit, including food, bio-fuels, water supply and hydropower, soil formation, pollination, storm protection and flood amelioration, carbon storage and climate stabilization and others) humans would not survive.

A variety of ecosystem services have been identified for the Caribbean (see Appendix 2) and have long been important to human wellbeing and livelihoods. For instance, apart from their timber value, forests (primary, secondary, upland, coastal) provide wood for fuel for large numbers of people on some islands (e.g. Dominican Republic, Haiti, Jamaica and the Windward Islands), ecotourism related employment for rural people in several countries (e.g. Dominica, Dominican Republic, Jamaica and St. Lucia), and recreation and education opportunities throughout the region, and a wide range of non-timber forest products of social, economic and medicinal importance are also harvested in virtually every country in the Caribbean (John 2005). In addition, forests (and many key biodiversity areas) provide a critically important role in protecting against floods and storms (illustrated by the tragic losses of life from floods following major storms in deforested upland areas of Haiti, such as the Massifs de la Hotte and de la Selle key biodiversity areas), in regulating water supplies for local communities and tourism developments (e.g. Cockpit Country and North Coast Forest Corridor), and also provide a crucial climate mitigation service as absorbers of CO_2. Caribbean mangrove forests (such as those in the key biodiversity areas of Jaragua National Park, Haitises, Portland Ridge and Bight, Black River Great Morass, Bluefields and Southern Great Lake), also provide multiple benefits including: nursery habitat for commercially important fish species; protection against storm and wave erosion; absorption of nutrients and trapping of sediments deposited by rivers, thereby reducing eutrophication and sedimentation in coastal waters; and restriction of the flow of seawater into the river systems and inland water sources (especially important for low-lying countries).

Table 8. Key Human and Development Statistics for the Insular Caribbean

Country	Area in sq km[1]	Population in 2008[2]	Population density	GDP per capita (in U.S.$ 2007) [4]	Official Development Assistance ($ million in 2005)[3]	Human Development Index Rank (2005)[3]	Life expectancy at birth (in years, 2000-2005)[3]	Under 5 mortality rate (per 1,000 live births in 2005)[3]	Population living below $2/day (%) 1990-2005[3]
Anguilla*	90	15,427	157						
Antigua and Barbuda	440	77,426	192	12,799	7.2	57		12	
Aruba*	190	105,287	534	25,253					
Bahamas	13,880	338,280	22	19,881		49	71.1	15	
Barbados	430	274,937	656	13,356	-2.1	31	76	12	
British Virgin Isles*	150	20,647	160	51,273					
Cayman Islands*	260	55,900	184	57,222					
Cuba	110,860	11,236,444	103	4,641	87.8	51	77.2	7	
Dominica	750	69,625	97	4,838	15.2	71		15	
Dominican Republic	48,730	9,625,207	195	4,202	77	79	70.8	31	16.2
Grenada	340	107,379	266	5,081	44.9	82	67.7	21	
Guadeloupe	1,710	405,500	268						
Haiti	27,750	8,373,750	322	611	515	146	58.1	120	65
Jamaica	10,990	2,687,241	255	4,147	35.7	101	72	20	18.7
Martinique	1,100	402,000	362						
Montserrat*	100	4,875	51						
Netherlands Antilles*	960	197,182	235	18,078					
Puerto Rico	8,950	3,942,375	442	23,426					
St. Kitts and Nevis	360	45,841	111	10,447	3.5	54		20	
St. Lucia	620	168,338	257	5,810	11.1	72	72.5	14	
St. Vincent/ Grenadines	390	109,022	304	4,660	4.9	93	70.6	20	
Turks and Caicos*	430	36,605	52						
U.S. Virgin Islands	350	109,840	314						

1. UNEP Environmental Outlook 2005. Land area includes inland water bodies.
2. UNSD Population, latest available census and estimates (2007 - 2008)
3. UNDP Human Development Report 2007-2008.
4. U.N. Nations Statistics Division (2009) - World Statistics Pocketbook and data is for 2007. http://unstats.un.org/unsd/economic_main.htm accessed 11 July 2009.

* = Overseas Country or Territory

Valuation of Ecosystem Services

To date, there have been few economic valuations of terrestrial ecosystem services in the region (partly a reflection of the costs of such research and lack of appropriate and agreed methodology), and the human and economic costs of their loss, which represents a key area in need of further investment. Existing studies have focused on valuation of watersheds and/or water services in Jamaica (in Cockpit Country key biodiversity areas: Pantin and Reid, 2005, Springer 2005a), St.Lucia (Springer 2005b) and in the Dominican Republic (Bonilla 2008); forests on Montserrat; protected areas on Jamaica (Cesar *et al.* 2000, Guingand 2008); and sand and beach resources on Antigua and Barbuda (Parker 2002).

For example, the Centre Hills, the largest intact forest area remaining on Montserrat, was found to provide a number of important environmental goods and services to the people of the island. An economic valuation study of this forest was conducted to increase the understanding of the economic importance of the forest and further the case for conservation of the area. First, a choice experiment was conducted on the Montserrat population to estimate monetary values for the aesthetic, species conservation and recreational services provided by the forest. On average, each household was willing to pay $80 per year for the control of invasive species. Second, the Total Economic Value (TEV) was calculated to indicate the relative importance of the ecosystem services from the Centre Hills forest, which produced a tentative estimate of around $1.4 million per year. The tourism value comprised 32 percent of the TEV, and, because the Centre Hills are the only source of drinking water on Montserrat, more than 30 percent of the TEV of the areas was due to water services. Species abundance (18 percent) and forest products for domestic consumption (15 percent) were also highly valued ecosystem services on Montserrat. Interestingly, one of the main messages to come out of the Economic Valuation was that tourists are willing to pay to visit the Centre Hills but the Montserrat Government is not currently capitalizing on this. Source: Van Beukering *et al.* (2008)

Unfortunately, there is very limited awareness of the critical importance of ecosystem services – the benefits from preserving them and risks and costs from their loss – and they are poorly understood and undervalued by markets, politicians and civil society in the Caribbean. As a result, they have not received the necessary focus, resources and investment, and the contribution of ecosystem services is not fully internalized in the price of the goods and services they provide. Consequently, areas important for these services (e.g. many protected areas, forest reserves, wetlands, low intensity agricultural areas, and indeed the highest priority key biodiversity areas are undervalued, and destroyed for “economic development” or managed in ways that undermine or degrade provision of the services. Encouragingly, there are signs that this ignorance is beginning to change. For instance, the President of the Caribbean Development Bank made an important speech on the issue at a recent international conference in the Turks and Caicos islands, the National Environment and Planning Agency of Jamaica is due to begin a project to undertake economic valuation of its natural resources in 2009, and the Caribbean Natural Resources Institute (CANARI) has been promoting market-based approaches to watershed services for some years (see www.canari.org/alg2.htm) that are attracting increased attention. Equally important is collection and presentation of data on the costs and risks of the loss of ecosystem services, which can have enormous economic costs. The European Commission (2008) estimated the global loss of ecosystem services to be worth the equivalent of $75 billion every year from land-based ecosystems, and that current rates of environmental decline could reduce global GDP by 7 percent by 2050, with most impact on the poorer sections of society. Tourism revenues and associated employment, for instance, are often directly impacted by habitat degradation because of the loss of amenity value for activities such as hiking, birdwatching, fishing, swimming, and diving (estimates of economic losses from coral reef degradation in the Caribbean range from $350 million to $870 million/year by 2015).

Maintenance of ecosystem services is likely to become even more important in the region as global food prices rise, urban centers expand and demands on water supplies increase, and as climate change impacts accumulate, and valuation of ecosystem services needs to be seen as an integral part of any major development program or project and more widely adopted in the region. Ecosystem services need to be treated as part of the infrastructure investment for national economies and a critical input for economic growth (ecosystem services treated as inputs to sectoral outputs), and decisionmakers across all development sectors need to consider the cost of loss of ecosystem services on sectoral productivity and economies.

Impact of Environmental Degradation on the Poor

Poor people are often directly dependent on goods and services from ecosystems, either as a primary or supplementary source of food, fodder, building materials and fuel. In the Caribbean, the poorer sections of society have had to rely more on the natural environment for food, shelter, livelihoods and healthcare than richer groups and have traditionally exploited common "free" resources such as wood, other forest products, fish and mangroves in the Caribbean for centuries. This makes them highly vulnerable to the impacts of ecosystem degradation and poor environmental management, such as floods and pollution, and climate change further erodes the quality of the natural resource base, thereby reinforcing conditions of poverty. On the other hand, it is also the poor that participate in illegal logging and hunting when no other resources are available to them. Both of these make biodiversity conservation and sustainable management of natural resources an essential tool in the fight against poverty.

A significant number of both public- and private-sector funded programs and projects have sought to address poverty alleviation and improve livelihoods of poorer communities through biodiversity conservation and sustainable environmental management. Examples include the OECS Protected Areas and Associated Livelihoods Project, which examines approaches to enhancing livelihoods benefits through protection of biodiversity in protected areas.

Policy, Legislation and Planning

Environmental policy in the Caribbean tends to mostly address environmental issues and impacts rather than their underlying root causes/drivers, such as population increase. In the case of climate change, Caribbean countries do not consider themselves to be net contributors and therefore policy responses are largely limited to adaptation (however, the Caribbean's tourism industry depends heavily on air travel and cruise ships, and there is an argument that these emissions should be considered in calculations of the region's CO_2 contribution).

International and Regional Environmental Agreements and Plans

All the countries in the hotspot are active participants in the main multilateral environmental agreements (MEAs). All are signatories to the three "Rio conventions"– the UN Convention on Biological Diversity, UN Convention to Combat Desertification, and the UN Framework Convention on Climate Change —and most are members of the other key biodiversity related agreements, such as Ramsar, World Heritage Convention and Convention on International Trade in Endangered Species, except for the Convention on Migratory Species.

At the regional level, the main agreement is the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention) and its three Protocols, which together constitute the only legal instrument for regional cooperation on environmental issues for the wider Caribbean. Thirteen of a possible 28 countries have ratified the Protocol, representing 22 Caribbean Islands Hotspot countries and territories. Five additional countries are signatories without having ratified. The dependent territories participate in these agreements through their respective metropolitan (or mainland) countries, and France, the

Netherlands, the U.K. and the United States are all full participants in the regional multilateral agreements and processes, although not all are properly meeting their commitments, e.g. required legislation has not been enacted, management plans not developed, and there is a lack of biodiversity action plans.

There are a number of important environment and sustainable development related regional and sub-regional strategies and action plans for the Caribbean, namely:

- The Barbados Programme of Action (BPOA) that was adopted in 1994 to facilitate the implementation of Agenda 21 in SIDS and sets out sustainable development priorities for the Caribbean SIDS.
- The St. George's Declaration of Principles of Environmental Sustainability in the OECS, signed by all OECS Member States in 2001 that seeks to provide an indigenous approach to implementing the BPOA within the context of the specific vulnerabilities and special needs of the OECS sub-region.
- The OECS Environmental Management Strategy (2000, revised 2002).
- The Caribbean Action Plan adopted in 1981, which covers the Wider Caribbean Region and led to the creation of the Caribbean Environment Programme and the Cartagena Convention.
- The Caribbean Planning for Adaptation to Climate Change Project, which addresses adaptation to climate change and involves a combination of national pilot/demonstration activities and regional training and technology transfer.

However, the complexity of the international and regional policy framework and the demands it places on governments often overstretch the limited staff and technical resources of national environmental management institutions (particularly in the smaller states) and as a result, obligations under these agreements are sometimes not adequately carried out. Reporting, particularly in the absence of adequate systems for monitoring and data management, is perceived by many as a costly exercise that yields few tangible benefits, consequently reporting on many of these international environmental obligations is often inadequate. The cross-cutting nature of some MEAs is also a challenge. Countries are required to adopt sectorally integrated, socially inclusive implementation strategies and to create multi-sectoral awareness about their purpose. As a consequence, a number of countries have established national mechanisms to coordinate implementation of MEAs, such as the Cabinet-level National Coordinating Mechanism on Antigua and Barbuda, and the Environmental Coordinating Unit on Dominica.

National Policy and Legislation

Most countries have significantly updated, or are in the process of updating (e.g. Haiti and St. Vincent), their policies and legislation on biodiversity, environmental management and sustainable development, in the last 20 years, and obligations under international agreements have helped drive this process (Brown *et al*. 2007). However, there exists significant variation among countries with regard to their comprehensiveness and effectiveness, particularly with regard to the protection of threatened biodiversity and ecosystems (BirdLife International 2008), and there is a need for specific analyses of "gaps" in legislation and policies, which very few countries (e.g. Jamaica [NEPA 2003]) have undertaken recently. Overall, national public policy frameworks for environmental management remain largely oriented toward control, regulation and a reactive approach to environmental issues, although new approaches and instruments, including environment service markets, have begun to be promoted by some donors, governments and NGOs as means of changing destructive patterns of behavior.

Although only a few countries have developed a National Sustainable Development Strategy (NSDS), most have formulated a national environmental policy, a National Environmental Management Strategy (NEMS) or National Environmental Action Plan, National Biodiversity Strategies and Action Plan (NBSAP), and National Action Plans (NAP) to Combat Desertification, which guide environmental management. Unfortunately, the limited government capacity, especially in the smaller island states, has slowed development of policy and legislation.

Donor agencies have supported development of key strategies and plans e.g. a regional project funded by the Canadian International Development Agency (CIDA) has enabled most OECS countries to develop a NEMS, and GEF financing has been provided to enable the development of NBSAPs and National Reports to the Rio Conventions, as well as to prepare National Capacity Self Assessments (NCSAs). However, donor support to build capacity to meet reporting obligations has often meant employing external consultants to prepare reports, which does not address the issue in the longer term (Renard and Geoghegan 2005). The situation is made worse by the fact that international conventions and leading donor agencies frequently require countries to prepare specific programs and plans of actions which often duplicate each other, fail to build on earlier efforts and cause a significant drain in the resources of the agencies that are expected to prepare them (Brown *et al*. 2007).

Protected Area Networks

Protected areas have long been used as a key legislative and management instrument for conservation and development at the local and national levels in the Caribbean islands. The first such site—the Kings Hill Reserve in St. Vincent—was established in 1791 for "the purpose of attracting clouds and rain…the benefit and advantage of the owners and possessors of lands in the neighborhood thereof" (Birdsey *et al.* 1986). Other early protected areas were established in Jamaica in 1907 (the Morant and Pedro Cays, still nominally protected), Puerto Rico (the Caribbean or Luquillo National Forest, 1907), Grenada (Grand Etang Forest Reserve, 1910) and Cuba (Sierra Cristal National Park, 1930).

The World Database on Protected Areas lists some 749 protected areas in the region, covering 67,719 km^2 (Table 9), with more than half this area being marine (Chape *et al.* 2008). Protected areas are concentrated in IUCN Management Categories II, IV, and VI, with the stricter levels of protection (I-III) making up less than one third of the total number of sites. The breakdown by country shows that there is considerable variation in the total area protected. Cuba and the Dominican Republic have about 15 percent of their land area in managed conservation units, while Dominica has around 20 percent of its territory designated for protection, including marine site. In other countries, however, protected areas are effectively non-existent, as is the case in Haiti and Grenada, which both have less than 1.7 percent of their area protected (Haiti has only four reserves totaling approximately.25,000 hectares: Macaya Biosphere Reserve in the Massif de la Hotte Key Biodiversity Area; Parc National La Visite and Forêt des Pins in the Massif de la Selle Key Biodiversity Area; and Parc Historique La Citadelle, Sans Souci, les Ramiers (La Citadelle Key Biodiversity Area). Apart from national parks and wildlife reserves, many countries also have significant numbers of forest reserves, whose primary roles are watershed and biodiversity protection and timber management and have been critical components of most countries' environmental management strategies.

Most Caribbean countries have not had a systematic approach to the establishment of protected areas, although protected area reviews and gap analyses have been undertaken recently on some islands. Jamaica, for instance, is currently completing its Protected Area System Master Plan that will provide a framework for the sustainable management of Jamaica's existing and future protected areas. Protected area gap analyses have been produced for the Bahamas, Dominican

Republic, and some OECS countries (Antigua and Barbuda Dominica, Grenada, St.Kitts and Nevis, St.Lucia, and St.Vincent and the Grenadines) under the OECS Protected Areas and Associated Livelihoods Project discussed in the Current Investment section of this profile. These have shown that many national protected area networks are not comprehensive with key ecosystem types missing or under-represented, such as montane forest in the Dominican Republic, deciduous forest, dry woodlands, dry coastal scrub and mangrove forest on Grenada, and lowland and coastal ecosystems on Jamaica. Many important sites are also judged too small to be viable. For example, populations within the small protected area of forest in La Visite (Massif de la Selle Key Biodiversity Area) and Macaya (Massif de la Hotte Key Biodiversity Area) national parks on Haiti, for instance, may not be viable in the long term.

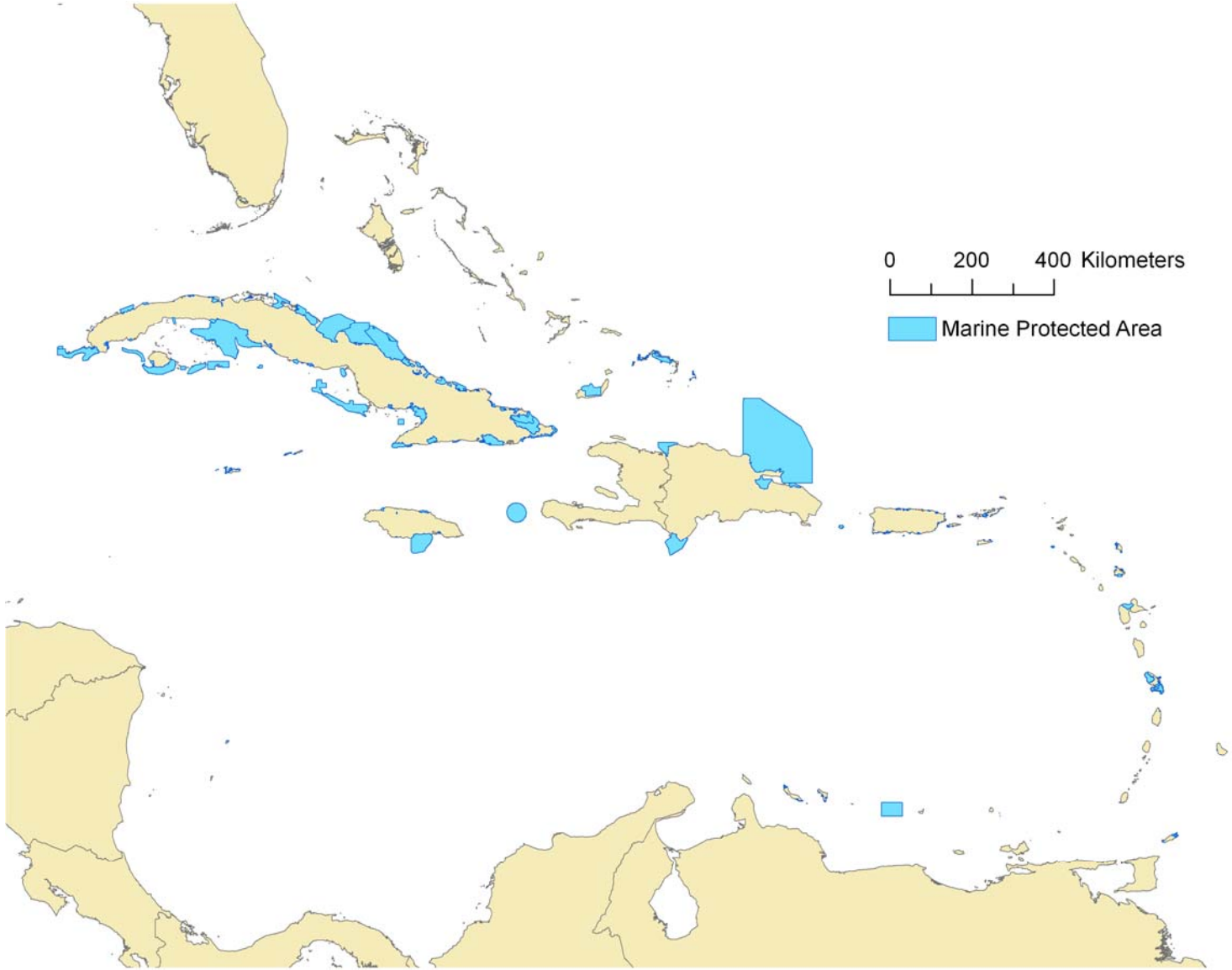
Apart from inadequate coverage and under-representation, protected area management is weak and ineffective on many islands and only a few countries have strong centralized and well-coordinated institutional arrangements for the management of protected areas. Chief amongst these are Cuba, with the Centro Nacional de Áreas Protegidas, and the Dominican Republic, with the Subsecretaría de Áreas Protegidas y Biodiversidad. National Parks and other protected areas are well established in many dependent territories, for example the Netherlands Antilles (Bonaire and Saba Marine Parks), the French départements (Parc National de la Guadeloupe, Parc National de la Guyane and Parc Naturel Régional de la Martinique), Puerto Rico (a comprehensive system of state forests as well as the federally managed Caribbean National Forest), and the British and U.S. Virgin Islands.

Table 9. Nationally and Internationally Protected Areas in the Caribbean Islands Hotspot, 2005

	National Protected Areas		Biosphere Reserves		Ramsar Sites		World Heritage Sites	
Country/ Territory	**Number of Sites**	**Total Protected Area (km^2)**	**Number of Sites**	**Total Protected Area (km^2)**	**Number of Sites**	**Total Protected Area (km^2)**	**Number of Sites**	**Total Protected Area (km^2)**
Anguilla	8	<1						
Antigua and Barbuda	13	66			1	36		
Aruba	4	3			1	1		
Bahamas	45	2,832			1	326		
Barbados	7	3			1	0		
Cayman Islands	48	241			1	1		
Cuba	70	35,192	6	13,837	6	11,884	2	1,038
Dominica	7	204					1	69
Dominica Republic	62	20,451	1	4,767	1	200		
Grenada	2	7						
Guadeloupe	22	456	1	697				
Haiti	9	74						
Jamaica	168	3,909			2	132		
Martinique	25	774						
Montserrat	18	11						
Netherlands Antilles	15	144			5	19		
Puerto Rico	58	2,187	2	41				
St.Kitts and Nevis	2	26						
St.Lucia	52	104			2	1	1	29
St.Vincent/ Grenadines	28	83						
Turks and Caicos	34	717			1	586		
Virgin Islands (British)	35	52						
Virgin Islands (U.S.)	17	183	1	61				
Total	**749**	**67,719**	**11**	**19,403**	**22**	**13,186**	**4**	**1,136**

Source: Chape *et al.* (2008)

Figure 14. Map of Marine Protected Areas in the Caribbean Islands Hotspot



Overall, there is a lack of resources or political will to establish new protected areas and, to date, there have been few attempts to link protected areas together to create more coherent and effective landscape-level protected systems. Linking protected areas would help maintain the viability of small, often ecologically isolated populations through improving opportunities for dispersal and gene exchange, migration and evolutionary processes, and buffer against the additional stress climate change is likely to place on protected areas (Chape *et al*. 2008). However, the Caribbean Biological Corridor initiative established by the governments of Cuba, the Dominican Republic and Haiti could prove a useful model for other parts of the region, and help link important biodiversity areas that could be particularly valuable in the face of climate change impacts. It includes important areas in each country: Massif du Nord Conservation Corridor (Haiti), Massif de la Hotte Key Biodiversity Area (Haiti), Massif de la Selle – Bahoruco-Jaragua Conservation Corridor (Haiti/Dominican Republic), Cordillera Central Conservation Corridor (Dominican Republic); and the Sierra Maestra mountain range, Baracoa, Nipe and Saguá (eastern Cuba). Along with expected participation from the European Commission, UNEP and the World Food Program, the initiative includes preparing a Plan of Action, signing relevant accords, strengthening protected area management and other activities.

Some countries offer tax incentives to landowners of biologically important areas to maintain their land, which offers the opportunity to link existing protected areas or forest reserves through private land corridors. In Jamaica, for instance, private lands declared as forest reserves or forest management areas can be entitled (under the Forestry Act of 1996) to property tax exemptions (498 hectares of land have been thus declared), and in Puerto Rico, local and federal laws provide for private entities to set aside part of their land as conservation easements (BirdLife International 2008). These may be suitable approaches for other islands where private lands contain large, mature tracts of secondary forest or wetland habitat. However, legislation for private reserve establishment is non-existant in most countries in the Caribbean.

In many countries, NGOs and other nonprofit organizations have responsibility for the management of some or all protected areas. These include the STINAPA Bonaire (three national parks), the Bahamas National Trust (25 parks and protected areas), the British Virgin Islands National Parks Trust (21 national parks and protected areas), the CARMABI Foundation in Curaçao (nine conservation areas), Grupo Jaragua for Jaragua National Park on Dominica, the Conservation Trust of Puerto Rico, and the Turks and Caicos National Trust. These have often received support (capacity building, training, costs of materials and other financial assistance) from international NGOs and private organizations active in the region including The Nature Conservancy, CANARI and BirdLife International. In many cases, these management arrangements work well, but they have not been so successful in others.

Generally, protected area establishment and management have been less successful in the smaller, less developed countries, and traditional terrestrial protected area models may not be well suited to small ecosystems with diverse uses and weak institutional capacities (Brown *et al*. 2007, Parsram 2007). Another challenge to establishing comprehensive networks of protected areas (and land-use planning generally) is that frequently only a small percentage of the land is in government ownership, e.g. 3 percent on Anguilla. Consequently, new models for protecting biodiversity and ecosystems through multi-stakeholder management arrangements (including local groups and the private sector) have been developed in recent years and are seen as a key area for further research and investment. Despite the progress made during the past decade, in general, the Caribbean Islands emerge as a top priority for the expansion of the global protected areas network (Chape *et al*. 2008, Brown *et al.* 2007).

Sustainable financing for protected areas remains one of the biggest challenges in the insular Caribbean, and probably all protected areas are under-funded, which impacts their management and hence long-term survival. Payment for the services provided by protected areas, such as tourism and recreational activities, watershed protection, and seed and seedling source banks are not fully captured and where payments are made (usually as entrance fees) these frequently have little relationship to the true cost of maintaining the protected area or the real value of the ecosystem services provided by the protected area. Some countries have instituted a "visitor" or "departure" tax that is being used to fund protected areas, e.g. the Cayman Islands Government Environmental Protection Fund (EPF) was established in 1997 through a levy of $2 to $4 tax on every person departing the country. One of the main purposes of the fund is the purchase of conservation land and the government has recently confirmed its intent to use the EPF to purchase land in the Barkers area on Grand Cayman, as a move toward establishing the country's first national park. The Turks and Caicos Islands have also instigated a visitor tax that is used to fund protected area management. Many of the GEF- and other donor-funded protected area projects in the region have been focusing on trying to improve the financial sustainability of national protected area networks (see Current Investments) through the creation of protected area trust funds, debt-for-nature swaps and other approaches, but financing continues to be a challenge especially for the smaller or less visited protected areas that may need new, innovative local solutions involving greater community and business sector arrangements to ensure sustainability.

Mainstreaming of Environment into Other Sectors

Most governments have made some attempt to incorporate environmental concerns into broader non-environment national policy and programs, such as national economic development plans, sector plans and poverty reduction strategies, and public sector investments in environmental management have been significant in some countries, particularly for sewage treatment, solid waste management and water catchment management. In addition, Environmental Impact Assessments (EIA) are a requirement for all large development projects (mining, construction, transport) in most of the Caribbean countries and all countries have environmental standards regarding pollution levels, although monitoring and enforcement vary widely between countries and are generally low. Capacity to assess the quality of EIAs is limited in most countries, and political interference in favor of powerful economic interests is common.

The development of these policies and programs, as well as integrated coastal zone management policies and plans, have been key tools in the mainstreaming process because many of these were developed through a participatory process that has helped promote cross-sectoral linkages and raise awareness among decisionmakers in other key sectors (e.g. agriculture, tourism and industry). However, biodiversity conservation and sustainable use of natural resources are still seen as "niche" issues to a large extent and the responsibility of environment agencies in many countries, which a not politically powerful.

Indeed, strategic instruments, such as Strategic Environmental Assessments, are not yet widely used in development planning in the Caribbean to assess, limit and mitigate wider development programs and projects such as those for transport, industry or even tourism sectors. In addition, despite the critical importance of ecosystem services for the region's economic development, links between protected and other natural areas and non-environment sectors, especially in policy development, legislation and land-use planning, are still weak and need to be addressed.

Civil Society Framework

Local and National Organizations

Almost all of the island states have at least one NGO with a mission that includes biodiversity and related conservation, and many have co-management responsibilities for protected areas. Almost every English-speaking Caribbean island, both independent and overseas territory, has a National Trust organization that, while separate from the national government, normally has close links to it (e.g. Bahamas National Trust, National Trust for the Cayman Islands). Several other islands also have trusts or similar quasi-governmental organizations (e.g. the Conservation Trust of Puerto Rico). Typically the national or territorial government will have passed enabling legislation for the trust, will reserve membership on the board of directors, and may transfer funding to the trust. The Bahamas National Trust, Jamaica Conservation and Development Trust and Conservation Trust of Puerto Rico are larger organizations with full time staffs and they compete for international funding. Others reflect the smaller size and population of their islands.

The trusts have a key role in management of state-owned properties (some have historical or cultural values) and in public-oriented activities around these sites. The Bahamas National Trust, for example, has responsibility for management of the entire national protected areas system (25 national parks, 700,000 hectares), and provides environmental education for thousands of Bahamian children. The Conservation Trust of Puerto Rico owns and manages 20 natural and historic properties covering more than 7,000 hectares. Formal linkages among the trusts do not seem to exist.

NGOs in other islands have evolved in different ways, often through an interest in an important site (for example, the organization Grupo Jaragua for Parque Nacional Jaragua in the Dominican Republic), or resource (Société Audubon de Haiti/birds; AMAZONA, Guadeloupe/parrots). The larger island of Jamaica has both trusts (Jamaica Conservation and Development Trust, Dolphin Head Trust) and conservation-related nonprofits (Windsor Research Centre). Some of these organizations are Partners in the BirdLife International network and/ or members of IUCN, which is now establishing a Caribbean Program. An informal network of conservation and sustainable development organizations, REZO-EKOLO, has developed in Haiti under the leadership of the Federation des Amies de la Nature (Friends of Nature Federation). At least two of the 13 member organizations concentrate on environmental restoration and community development efforts at key biodiversity areas in Haiti: Fondation Seguin works in La Visite National Park (Massif de la Selle Key Biodiversity Area), and Fondation Macaya pour la Developpement Local (Macaya Foundation for Local Development) in Macaya National Park (Massif de la Hotte Key Biodiversity Area).

Community-based organizations, generally smaller and more narrowly focused than the NGOs described above (although without a firm distinction), are playing an increasingly important role in biodiversity conservation in the Caribbean. These organizations may be organized around a business or productive activity like agriculture or fisheries, and may indirectly benefit conservation. In recent years, the Jamaican Forestry Department has established Local Forest Management Committees (LFMCs) to enable local communities to participate in the planning, management, protection and sustainable use of local forests. In the Cockpit Country Key Biodiversity Area, for example, there are about 30,000 hectares of state-owned Forest Reserve in parcels of differing sizes, interspersed with rural communities. LFMCs there have identified sustainable livelihoods, developed local capacity in forest management and resource monitoring, established environmental education programs, and other activities. In the Dominican Republic, three community organizations have developed in the Jaragua-Bahoruco-Enriquillo Biosphere

Reserve; one of these is centered on the Fondo Paradí región of the reserve's buffer zone, and promotes ecotourism and sustainable use for the area's impoverished communities. Other successful regional experiences of community co-management of natural resources include collaborative management of the Mankòtè Mangrove in St. Lucia (Geoghegan and Smith 2002).

In Cuba, there are a number of institutions with active involvement in biodiversity conservation. In addition to the agencies directly responsible for conservation (e.g. Centro Nacional de Areas Protegidas, CNAP), the Universidad de Habana and BIOECO fulfill a similar function to the trusts in other islands. Others include Pronaturaleza (partner with Wildlife Trust) and Fundacion Nunez Jimenez. The latter has been an important partner of the Environmental Defense Fund, WWF-Canada and other international organizations working in Cuba.

Regional Organizations

Regional organizations such as the Association of Caribbean States and the Caribbean Community have offices dealing with a number of environmental and sustainable development themes, however, few relate directly to non-marine conservation. For an excellent discussion of these, see "A Situation Analysis for the Wider Caribbean" undertaken by IUCN (Brown *et al.* 2007). CANARI is a non-profit multi-disciplinary research institute, which was established more than 20 years ago. Its main office is in Port-of-Spain, Trinidad with a small office in Barbados. CANARI's mission, which is focused on the islands of the Caribbean, is to promote equitable participation and effective collaboration in managing the natural resources critical to development through: applied and action research on, and analysis, monitoring and evaluation of, innovative policies, institutions and approaches to participation and governance; sharing and dissemination of lessons learned, including capacity building; and fostering partnerships, particularly those that build on regional assets and talents and contribute to closer regional cooperation. CANARI has been particularly active in the area of building capacity for participatory natural resource management, including development of a framework for understanding and assessing organizational capacities for co-management (Krishnarayan *et al*. 2002) and has reviewed participatory forest management in the insular Caribbean (CANARI 2002). The Caribbean Conservation Association, based in Barbados, has provided environmental education and capacity building for many of the islands, through, for example, the recently concluded Caribbean Environmental Program.

The Society for the Conservation and Study of Caribbean Birds (SCSCB) has become a leading network for science-based species-level conservation in the region. SCSCB members and member organizations have pursued bird-centered conservation science, education and on-the-ground activities in their own countries and territories, much of which has broader biodiversity benefits. In an example of cross-cultural and cross-regional conservation, the Society's West Indian whistling-duck project has brought critical education and awareness of wetland conservation to thousands of students and teachers throughout the region. Most of the SCSCB partners are also part of the global BirdLife International partnership for bird conservation. BirdLife has recently completed an exhaustive process to identify IBAs in the region (recognized as key biodiversity areas in this profile), and conservation efforts are beginning to coalesce around these sites with the establishment of site support groups. The Wider Caribbean Sea Turtle Conservation Network is a similar regional network that has promoted science, environmental education, and management of these species. This profile includes sea-turtle nesting beaches among its key biodiversity areas.

The Panos Institute Caribbean is a regional organization that sponsors training for journalists, exhibits, briefings and reports to increase media coverage on sustainable development issues throughout the region. It works with local communities, journalists and media outlets on issues

such as climate change, land degradation, energy, mining, coastal resources management and sanitation.

International Organizations

The involvement of international NGOs is surprisingly limited in the region, given the proximity of the Caribbean to North America and its popularity among vacationers. The Nature Conservancy is one of the few larger NGOs active in the Caribbean, and maintains offices in the Bahamas, St. Croix, Jamaica and the Dominican Republic. The Nature Conservancy Caribbean staff work with in-country organizations in many activities with direct biodiversity benefits, including control of invasive species and fire, land securement and protected area management. The Nature Conservancy was also instrumental in organizing the Caribbean Challenge. IUCN has recently developed a Programme of Work for 2009 to 2012 for the Caribbean region under its IUCN Caribbean Initiative (IUCN 2008), and started to implement this program in August 2009.

BirdLife International is a global network of nongovernmental conservation organizations with a special focus on birds. In the Caribbean, BirdLife is formally represented by the Bahamas National Trust, Centro Nacional de Áreas Protegidas (Cuba), Grupo Jaragua (Dominican Republic), Sociedad Ornitológica Puertorriqueña (Puerto Rico), Royal Society for the Protection of Birds (U.K. Overseas Territories), Vogelbescherming Nederland (Netherlands Antilles), Ligue pour la Protection des Oiseaux (French Overseas Territories), and National Audubon Society (U.S. Territories). The BirdLife Caribbean Program is also working with organizations in a number of other Caribbean countries (including Barbados, Haiti and Jamaica) and maintains contacts in all countries and territories where there is currently no formal Partner organization. At the regional level BirdLife works closely with SCSCB. The BirdLife Caribbean Program maintains a small coordinating office in Puerto Rico supported by the Americas Regional Secretariat. BirdLife has worked with local people for many years to secure the conservation of IBAs; many different approaches have been adopted, from communities in action, local advisory committees, stewardship groups, community co-operatives and friends of an IBA. Collectively they are known as Site Support Groups (SSGs, sometimes referred to as Local Conservation Groups). SSGs—groups of voluntary individuals who, in partnership with relevant stakeholders, help promote conservation and sustainable development at IBAs and other key biodiversity sites—are active at some IBAs in the Bahamas, Dominican Republic, Jamaica and Puerto Rico.

Fauna and Flora International (FFI), a global conservation organization based in the U.K. has been active in the Lesser Antilles since 1995, including running or supporting biodiversity projects in Anguilla, Antigua and Barbuda, Barbados, British Virgin Islands, Dominica, Montserrat, Saba, St. Eustatius, St. Kitts and Nevis, and St. Lucia. FFI is a founding member of the Antiguan Racer Conservation Project (Offshore Islands Conservation Project), which has eradicated invasive rats and mongooses from 11 islands to date. This has enabled many threatened native wildlife to increase significantly, including the Critically Endangered Antiguan racer (*Alsophis antiguae)* snake, and prompted the creation of Antigua's largest protected area for biodiversity conservation. FFI has also eradicated alien invasive species as part of wildlife restoration projects in Anguilla, St. Lucia and the Bahamas, and specializes in building local capacity to monitor and conserve threatened wildlife, the sustainable use of forests and bush meat species, and protected area management.

Durrell Wildlife Conservation Trust is an international conservation organization based on Jersey in the Channel Islands (U.K.) that carries out species-led conservation projects around the world. With an emphasis on rare and endemic species, Durrell focuses on conservation of islands and isolated highland regions that harbor a unique and often fragile biodiversity. Durrell has worked with in-country partners in the Eastern Caribbean since the 1970s and established a permanent

presence on St. Lucia in 2002. Durrell has long-standing conservation projects on St. Lucia for endemic species such as the Amazon parrot, the whiptail lizard and iguana. On Antigua Durrell was a founding a member of the Antiguan Racer Conservation Project and is currently studying the population genetics of the species. On Montserrat Durrell led a biodiversity assessment of the Centre Hills region and is now leading the recovery of the highly threatened mountain chicken frog. In the Greater Antilles, Durrell has focused on iguanas; it has been a long-term member of the Blue Iguana Recovery Programme on Grand Cayman and is studying the Little Cayman rock iguana. On Hispaniola Durrell has started a three year Darwin-funded project on the endemic solenondon and hutia found there. Durrell also provides technical assistance to its in-country partners and builds links between them and its *ex situ* and training facilities in Jersey.

Rare, an international conservation organization based in the United States, ran its first signature "Pride campaign" more than 20 years ago on the island of St.Lucia, helping save the St.Lucia Parrot from the brink of extinction. These two-year social marketing campaigns are designed to equip local conservation leaders with the tools and skills to achieve conservation results. By raising local awareness of and support for wildlife conservation, the campaigns inspire communities to take pride in and protect local endangered species. Post Pride campaign studies revealed that of the eight parrot-focused Pride campaigns run in the Caribbean, seven of the eight target species have increasing or stable populations.

TRAFFIC, the wildlife monitoring network of WWF and IUCN, is currently working in the Caribbean on marine turtles with projects to develop brochures and other materials aimed at cruise ships visitors to encourage them not to buy illegal sea turtle parts and a government campaign in the Dominican Republic to crack down on shops illegally trading such items.

The Wildlife Conservation Society (WCS) has been involved in biodiversity conservation in Cuba since 1999 on efforts ranging from applied research on threatened wildlife, to facilitating exchanges between U.S. and Cuban educators, scientists and protected area managers. It has collaborated closely with several governmental agencies and local organizations, including Cuba's foremost biodiversity nongovernmental organization, ProNaturaleza. It is currently involved in joint projects to protect the three largest wetlands in the country: Ciénaga de Zapata, the Delta de Cauto and Ciénaga de Lanier. In eastern Cuba, WCS has partnered with the Centro Oriental de Ecosistemas y Biodiversidad to promote biodiversity cooperation between Cuba and other Caribbean nations, evaluate climate change in montane ecosystems and promote the conservation of migratory birds and rare endemic bird and amphibian species. In addition, WCS has built an environmental education programs and supported the training of Cubans.

Environmental Defense Fund (EDF) has worked in Cuba since 2000 on scientific research and conservation strategies for protecting coastal and marine resources. EDF collaborated with Cuban scientists to help create Cuba's extensive network of marine protected areas, finalize the boundaries to protect critical fish spawning grounds, and produce various articles and publications, including a handbook on coastal conservation in Cuba. Currently, EDF is working with Cuban partners on a variety of projects related to fisheries science and management and the conservation of vulnerable coastal ecosystems.

Also in Cuba, WWF-Netherlands is taking over responsibility for several activities previously supported by WWF-Canada. Plans call for maintaining an office in Havana (which is the only office occupied by an international environmental NGO in the country), and for focusing on marine and coastal priorities, mostly for protection of marine turtles.

Private Sector

Efforts to involve the Caribbean's largest industry, tourism, in biodiversity conservation have not been successful except on a small and local scale. Some resort companies have participated in environmental certification schemes such as Blue Flag (clean beaches), and Green Globe (hotels), and Quality Tourism for the Caribbean through the Caribbean Alliance for Sustainable Tourism but have generally not ventured out into the larger watershed upon which they depend. Smaller adventure- and outdoor recreation-oriented hotels have supported conservation of the resources upon which they depend (e.g. Dominica Nature Island Standard of Excellence). Small-scale, community-run ecotourism ventures are now open for business in several countries (e.g. Jaragua National Park Key Biodiversity Area, Dominican Republic), and the potential exists for such operations to expand with spin-off from the larger resorts and cruise ships. The Small Tourism Enterprise Program of the Organization of American States recently unveiled the Caribbean Experiences website (www.caribbean-experiences.com) featuring properties that demonstrate innovation, authentic cultural, and off the beaten-path experiences, high quality vacations and environmental stewardship while staying at small, handpicked properties as an alternative to large chain resorts.

The National Confederation of Dominican Cacao Producers (CONACADO) provides technical and business assistance to more than 10,000 small producers on almost 30,000 hectares. While helping to guarantee a living wage to poor families, CONACADO devotes funds to projects in education, health and community development. Dominican partners are beginning to establish these farms in the buffer zones of protected areas in the north-east, providing a stable, forest-like habitat and helping to deter the advancing agricultural frontier.

Universities

While there are a small number of excellent universities in the region, much of the primary research in the region is still carried out by researchers based in North America, Europe and elsewhere (although it is often done in partnership with local universities) and there is growing awareness that visiting researchers and international projects have a responsibility to help with this training and capacity issue. For instance, the Kirtland's Warbler Training and Research Program, which is a collaboration between Bahamas National Trust, the U.S. Forest Service, The Nature Conservancy and the College of the Bahamas, has been exemplary in providing opportunities for Bahamian students to gain expert field and academic training.

There are several strong programs in marine biology and conservation in the Caribbean, but only a few universities offer curricula in natural resource conservation and management. The University of the West Indies offers a Master of Science (MSc) in Natural Resource and Environmental Management through its Centre for Resource Management and Environmental Studies at the Barbados campus, with streams in coastal and marine resource management, climate change, and water resources management. The University of the West Indies' campus at St. Augustine, Trinidad currently offers a MSc and Diploma course in the Science and Management of Tropical Biodiversity, and is currently developing a joint MSc on Biodiversity Conservation and Sustainable Development for the Caribbean in collaboration with the Universities of Belize and Guyana, the Anton de Kom University of Suriname and Oxford University, with funding from the European Union through its Edu-Link program. This new MSc is expected to begin in 2010-2011. The UWI campus at Mona, Jamaica now offers a MSc course in Tropical Ecosystem Assessment and Management.

The Universidad de Oriente in Santiago de Cuba offers a Master of Science degree in Integrated Coastal Zone Management through its Center for Multidisciplinary Coastal Zone Studies. The University of Puerto Rico offers an undergraduate degree in Wildlife Management at the

Humacao campus, and several campuses offer courses in conservation biology and associated fields. Recently, UPR at Rio Piedras established a graduate program (MS and PhD) in Environmental Science, which will have a conservation and management focus and includes faculty from various departments. Undergraduate training is also provided in agroforestry at the Centro Universitario de Guantánamo in Cuba.

Progress has been made through the creation of the Consortium of Caribbean Universities for Natural Resource Management, an organization of 16 universities that promote incorporation of natural resource science and management into university curricula. Short courses have been offered by CANARI and through the UNEP Caribbean Program. Graduate level training in professional conservation disciplines (forestry, wildlife, fisheries, conservation biology) is often sought outside the region in countries of the student's native language. The need for such training in-region, addressing Caribbean issues, has long been discussed, both in terms of traditional master's degree level offerings, as well as short courses for professional development.

Institutional Limitations and Impacts on Environmental Management

Limited capacity was ranked by Caribbean partners as among the most significant barriers to be overcome in addressing threats to biodiversity, and this applies to the staff in both government agencies and NGOs. While most assessments of this problem emphasize government personnel, it is clear that NGOs, especially in the smaller islands of the Lesser Antilles, mostly do not have the capacity to fully participate in government decision-making processes and defend biodiversity conservation. A co-management role in protected areas has been successfully fulfilled in the Bahamas and Puerto Rico, however, in other countries this role is limited to single sites if at all, such that gaps in protected area and natural resources management are not being filled. Indeed, there seem to be limits to capacity building in the smaller islands that may only be overcome by shared regional approaches (Parsram 2007).

Some regional and international NGOs, notably CANARI and The Nature Conservancy, have targeted institutional capacity building as a major focus for their work in the hotspot, however much of the capacity building in the NGO community is done through specific project funding as core funds are usually very limited. In this regard, the region's GEF Small Grants Programme is a particularly important source of funds for capacity building for both NGOs and community-based organizations, and investments to further build local capacity are encouraged.

Capacity issues frequently come down to lack of financial resources. Some funding has been short-term, project driven and rarely strategic, and this has worked against building both sustainable institutions and environmental management, whether in the private or government sector. Funding is particularly needed for building long-term sustainability of NGOs in the Caribbean. Unfortunately, due to small economies and tax receipts, the marginalization of the environment sector compared with other sectors such as tourism, and level of debt of many of the Caribbean governments (increasing due to the global crisis) the outlook for additional government investment in capacity building for biodiversity conservation and sustainable environmental management is not encouraging, and there are concerns about capacity to deal with emerging concerns, such as employment of new technologies, e.g. biotechnology and biosafety, alternative energy, climate change, and environment and trade. It is likely that capacity building will need to continue to be a key focus for donor and international NGO investment in the Caribbean islands for the foreseeable future.

Many of the region's environmental and community organizations also still work in relative isolation from each other, with weak networks due to often intense competition between groups for limited funding and a project-centered approach to much of their work. While there are some

examples of successful collaborative groupings in the Caribbean (perhaps the best example being SCSCB, the effectiveness of the region's civil society could be improved by more linkage, liaison and partnerships and particularly support for networks and development of common strategies, especially to improve dialogue with the private sector and government. Many NGOs rely heavily on membership subscriptions and consequently there is a high need to service members' wishes, which often places a heavy drain on staff time and resources and reduce their effectiveness in dealing with other priorities, such as engagement with government.

THREATS

Information on threats to biodiversity and their root causes and barriers to effective conservation in the insular Caribbean is scattered and there are few regional reviews (the most recent being Brown *et al.* 2007 for the whole region and for the EU overseas countries and territories EU/NIRAS (2007)). In many cases, statistics for the Caribbean are lumped with those for Latin America or Central America or presented for the wider Caribbean. However, national overviews of threats do exist as part of National Biodiversity Strategies and Action Plans (NBSAPs). These can vary considerably in the depth and quality of information and analysis. As part of this review, key threats and barriers were identified through the national and regional workshops.

Terrestrial biodiversity in the hotspot has been impacted by humans since the arrival of the Amerindians in the Caribbean some 6,000 to 7,000 years ago, but negative impacts increased substantially following the arrival of Europeans in the 1490s (Brooks *et al*. 2002) and have escalated in the last 50 years due to the rapidly increasing island populations and economies in the region. The main threats to the terrestrial biodiversity of the insular Caribbean are habitat destruction and fragmentation due to agricultural, urban tourism and industrial/commercial development driven by increasing population and affluence; overexploitation of living resources; and predation and competition by invasive alien species (see Table 10). Climate change is viewed as an increasingly significant threat. Pollution and sedimentation also pose a threat, particularly to freshwater biodiversity, but are considered less important. Due to the relatively small size of most Caribbean islands, pollution from terrestrial sources tends to end up in neighboring coastal waters and pollution is considered a major threat to the marine environment in the Caribbean (CEP, 2003). Sedimentation and pollutants flowing downstream affect coastal water quality, smother corals, kill fish and reduce the touristic and recreational value of beaches in many countries.

Table 10. Prioritized Threats in the Caribbean Islands Hotspot

THREATS	Average prioritization score (on a scale from 1–4)
Invasive Species	3.7
Residential, Commercial Development	3.5
Severe Weather, Climate Change	3.3
Human Disturbance	2.8
Agricultural Expansion, Intensification	2.7
Over-exploitation	2.7
Mining, Energy Production	2.6
Pollution	2.4
Transportation	2.3
Geological Events	1.2

Note: Threats were scored from 1 (insignificant threat or impact) to 4 (highly significant national threat/ impact), for each of a broad cross-section of Caribbean countries. The average of these scores is presented as a "Caribbean" score.

Major Threats

Invasive and Other Problematic Species and Infectious Diseases

Like other islands, Caribbean habitats are vulnerable to impacts of invasive species because of the generally small populations of indigenous species, evolutionary effects of isolation (such as loss of defensive behaviors) and the release of introduced species from natural enemies (Kairo *et al*. 2003). The spread of invasive aliens is generally considered the greatest threat to the native biodiversity of the Caribbean Islands Hotspot, especially to its endemic species, with invasive aliens recorded in a wide range of habitats throughout the hotspot.

The most damaging invasive aliens on islands are typically terrestrial vertebrates such as goats, feral cats, pigs and rats. These species are responsible for more than half of all animal extinctions on islands globally (Island Conservation analysis of IUCN data). The spread of invasive aliens is facilitated in the Caribbean region by its political, social and economic complexity and dependency upon imports (especially fresh food and live plants and animals), high degree of exposure to extreme weather events and the multiplicity of pathways and routes that alien species may use to reach the islands.

Even before the arrival of Europeans, people in the Caribbean were transporting food species from one island to another. However, as Europeans colonized the New World, the Caribbean became an important center for global commerce, linking the Spanish Pacific, European and African trade. Many species were either deliberately or accidentally introduced and this process has continued to the present. In many places these populations have persisted, causing ongoing devastation. For many other invasive aliens, such as marine species, the potential for introduction has grown in recent years through globalization and the associated increase in international trade, tourism and transport links. In addition, changes and development of some sectors, notably agriculture and aquaculture, have offered opportunities for introduction and spread of invasive aliens.

A review of invasive species threats in the Caribbean region identified 552 alien species, comprising 449 terrestrial (390 naturalized/invasive), 55 freshwater (10 naturalized/invasive), and 18 marine (16 naturalized/invasive) species, with 281 plant species reported as naturalized or invasive, of which 179 are trees (Kairo *et al*. 2003). Introduced terrestrial species vastly outnumber introduced freshwater and marine species, although this is probably a reflection of under-sampling of the marine environment (Kairo *et al.* 2003). Numbers on individual islands can be very high. For instance, 138 species have been reported as invasive in the Dominican Republic, including 17 of the 100 world's worst invaders (Lowe *et al*. 2001). Current information on species known to be naturalized or invasive in the insular Caribbean can be found on the Global Invasive Species Database of the IUCN Invasive Species Specialist Group (www.issg.org), and through the Inter-American Biodiversity Information Network Invasives Information Network (http://i3n.iabin.net/), although it is recognized as incomplete.

At the national level, most countries in the region have identified invasive aliens as one of the major threats to their biodiversity and the need for control activities. The Bahamas, for instance, established a National Invasive Species Strategy in 2003 and the Jamaica National Biodiversity Strategy Action Plan outlines 45 specific goals relating to invasive aliens, with the preparation of an invasive alien species management strategy listed as a key priority. However, quantitative data on Caribbean invasive species are still considered inadequate (Kairo *et al*. 2003) and limits the ability to design effective responses. There is also a low level of awareness from public to policymakers of the threats posed by invasive aliens and their environmental and economic impacts. A particular challenge to addressing invasive aliens arises from the fact that many of the major pathways for species introductions are critical to national economies.

Emerging infectious diseases are a newly recognized threat to biodiversity globally and in the Caribbean (Daszak *et al*. 2000), and amphibian chytridiomycosis is a striking example of this threat. Caused by the recently described chytrid fungus (*Batrachochytrium dendrobatidis),* chytridiomycosis is capable of driving amphibian populations and species to extinction (Skerratt *et al*. 2007). More than 200 species of frogs and salamanders are known to be susceptible to infection, and population declines attributed to the disease have occurred throughout Australia, the Americas and Europe (Berger *et al*. 1998, Lips *et al*. 2006, Bosch and Rincon 2008). In many of the 122 amphibian species extinctions that have occurred since 1980, particularly those that have disappeared from pristine areas, chytridiomycosis is suspected as the primary cause (Skerratt *et al*. 2007, IUCN 2008).

Within the Caribbean, the amphibian chytrid is known to occur on the islands of Cuba, Dominica, Montserrat, Puerto Rico and Tobago. The disease has been implicated in the decline of one of the world's largest frogs, the Critically Endangered mountain chicken (*Leptodactylus fallax),* on Dominica and Montserrat and is suspected in the probable extinction of three species from Puerto Rico (Burrowes *et al*. 2004). Chytridiomycosis presents a unique challenge for biodiversity conservation because the pathways of transmission and the way it kills amphibians are not well understood. It is thought to be transmitted by the introduction of infected animals, water, vegetation or soil to a new region. In addition, species are differentially affected by the disease: it is highly lethal for some species, while others can harbor sub-lethal infections and spread the fungus to naïve or highly susceptible species.

Residential, Commercial, Industrial and Tourism Development

The population and economies of most Caribbean countries have grown considerably in the last 50 years, leading to extensive development and much of which has occurred without adequate planning. This has led to the destruction and degradation of huge areas of natural habitats, transforming the coastal landscape and character of many Caribbean islands. Impacts have

included pollution from untreated sewage from residential and tourism developments and contamination from industrial sites; clearance of natural coastal vegetation for construction; clearance, dredging, channelization or in-filling of coastal wetlands and mangroves for marinas and ports; sand mining and beach and dune erosion; and increased consumption of water from surface and ground water sources leading to salt intrusion and changes in ecosystem function, and decreased availability of water supplies. In addition, housing and commercial/industrial initiatives are being sited on agricultural lands, displacing farmers to more marginal lands.

Of greatest concern has been the uncontrolled growth of tourism in the Caribbean region over the past five decades, with the widespread construction of hotels, marinas and associated developments, especially along coasts with white-sand beaches and coral reefs offshore. These are typically leeward, low wave energy beaches preferred by remnant populations of Critically Endangered hawksbill turtles for nesting. Development has often meant the removal of natural littoral vegetation, planting of ornamental trees, shrubs and grass for lawns and golf courses, filling-in of mangrove areas for marina developments and mosquito control, and construction of new roads to give access to coastal areas that previously could only be reached on foot or by sea. Overall figures for the area of natural habitats lost to tourism development in the hotspot are not available, but very few coastal areas now unaffected. For instance, around 80 percent of the mangroves of the British Virgin Islands have been destroyed, largely to make way for tourist development (BVIHCG 2007) and this is continuing.

Even legally protected areas have not been immune to tourism development pressure especially when it involves major international investment. In recent years, some Caribbean governments have moved to change and undermine the legal status of previously protected conservation sites to facilitate tourism development. Furthermore, some infrastructure projects such as road construction are often inextricably linked to major tourist developments and can have profound effects on biodiversity. A current example of this is the proposed “cross-country” road in St. Vincent. The road is planned to cut through the proposed forest reserves that make up the Central Mountain Range Corridor to provide access from a new airport to major tourist sites.

Many tourist sites are operating beyond their carrying capacities, both from biophysical and management perspectives. Influxes of high numbers of tourists during high season, for instance, frequently overtax public services, reduce local food stocks and water supplies, and generate vast amounts of solid and liquid wastes that must be accommodated by local municipalities that have very limited waste management facilities.

Severe Weather and Climate Change

The Caribbean is one of the most hurricane prone regions of the world and has had 260 tropical storms and hurricanes pass through the Eastern Caribbean and 347 through the Bahamas and Turks and Caicos region between 1851 and 2008 (Caribbean Hurricane network).

Damage to hurricane-hit natural environments can be enormous. For example, in 1988 Hurricane Gilbert (one of the most powerful ever recorded) hit Jamaica causing widespread damage, with 43 percent of trees in the John Crow mountains in the east of the island either toppled or with crowns broken and similar levels of damage in the Blue Mountains and Cockpit Country in Jamaica (Varty 1991, Bellingham *et al.* 1992). 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. Hurricanes also destroy important lowland and coastal habitats. For instance, the storm surge from Hurricane Ivan in 2004 swamped the central mangrove area in the Cayman Islands leaving standing salt water that eventually destroyed vast areas of virgin mangrove swamp. Similarly, red mangroves in Guadeloupe lost as

much as 75 percent of their surface area (80 percent of the biomass) after Hurricane Hugo (Imbert 2002). 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).

To a certain extent, Caribbean ecosystems are adapted to these extreme storms, and they have been a driving force for evolutionary change. Consequently, in one sense these natural phenomena cannot be considered a threat except that the loss of resilience of biodiversity due to reduction in population sizes and fragmentation from human activities increases their impacts and the risk of extinction. Many species of montane forest trees depend on the gaps and landslides created by hurricanes for regeneration, which is reflected in the growth characteristics of the trees and the ecology of climax forest in these islands (Lugo 2008). However, the loss, fragmentation and degradation of natural habitats in the Caribbean islands, especially in the last 50 years, has reduced the resilience of the region's remaining biodiversity to survive hurricanes and tropical storms, with species possessing small and often isolated populations (many threatened species) and specialist groups, such as montane nectar-feeding and fruit-/seed-eating birds (which may lose virtually all of their food sources from the storm), particularly at risk (Wunderle *et al*. 1992, Wiley and Wunderle 1993).

Hurricanes in the Caribbean are predicted to increase in intensity and possibly frequency under current climate change scenarios, addressed more fully in the next section of this report.

Human-Related Disturbance

The increase in the human population in the region, spread of agriculture and urban and tourism developments means that there are now few relatively undisturbed natural areas outside of protected areas and inaccessible mountain regions that are not subject to some form of human disturbance. Even within protected areas the growth in the numbers of visitors in recent years has led to degradation of vegetation and disturbance of fauna, due to carrying capacities being exceeded, such as along the Blue Mountain Peak trail in the Blue and John Crow Mountains National Park (two key biodiversity areas) in Jamaica.

Fire is a major cause of human-induced disturbance in the Caribbean and is commonly used to clear land for agriculture and settlements, prepare sugar-cane fields for cutting, to "clean" undergrowth in forests and to encourage new growth in grassland and lightly wooded areas in the dry season for pasturage (FAO 2006b). Forest fires in the insular Caribbean mostly affect dry forest types, but even montane forests with higher rainfall will burn in exceptionally dry years (Robbins *et al*., 2008). Much of the vegetation of the Caribbean islands (such as in Jamaica, Puerto Rico and the Lesser Antilles) is not fire-adapted and is adversely affected by fire, and indeed conservation efforts to protect forests are often thwarted by deliberate setting of fires, even within protected areas and forest reserves, to convert them to grasslands or agricultural land. However, Bahamian (including Turks and Caicos), Hispaniolan and Cuban pine forests, several species of palm that form extensive savannas on Cuba, and some herbaceous wetland types and localities on these and other islands (e.g. Zapata Swamp on Cuba) have evolved with fire, and are fire-dependent for their continued existence in their present forms. Other species are indirectly dependent in fire. For instance, the primary nest tree (*Colpothrinax wrightii*) of the Cuban parrot (*Amazona leucocephala)* is a fire-adapted savanna palm. Consequently, fire is not only a threat in the region, but a critically important natural process in some systems and an important land-management tool with potential to be managed to minimize its negative or maximize its positive aspects (Myers *et al*. 2004a, b).

A Caribbean Fire Management Cooperation Strategy (FAO 2005) was developed between 2005 and 2006 under auspices of the FAO, which aims to strengthen Caribbean fire management networking by encouraging closer collaboration among countries with similar ecological conditions. The strategy for the Caribbean identifies a number of research, training and management activities to improve wildfire management capacity in the Caribbean.

Agricultural Expansion and Intensification

Large-scale clearance of land for agriculture, principally sugarcane plantations at lower elevations, started in the 16th century shortly after European colonization began and increased through the 18th and 19th centuries, leading to widespread deforestation throughout the region (the timber being used for building and fuel for the sugar factories). This led to destabilizing erosion, loss of some permanent streams and a decline in land fertility (McElroy *et al*. 1990). Some of the smaller islands, including Antigua, Barbados, the Bahamas, Bonaire, St. Kitts and Nevis, and the U.S. Virgin Islands, lost virtually all of their native forest at this time or have been completely altered by agricultural developments. For instance, most of Antigua's land area—up to 92 percent—was under sugarcane cultivation for 300 years (the industry closed in the 1960s), virtually all trees on the island on Bonaire were removed by the early 19th century, and the deciduous and semi-deciduous forest that once covered Barbados was almost entirely cleared for cultivation (especially for sugarcane) within approximately 60 years of British settlement in 1627.

After the abolition of slavery, people dispersed into the areas surrounding the plantations and developed their own small plots, which led to further degradation of forests and wetlands. The later rise of new agricultural export markets led to further periods of intense deforestation. Recent threats to rainforest from agriculture come from extension of cocoa, coffee and tobacco plantations, such as for Blue Mountain coffee in Jamaica.

The abandonment of sugar and other major crops such as cotton on some islands due to changed economic conditions or a reduction in soil fertility often resulted in transformation to pasture and an increase of livestock production, especially cattle. Consequently, overgrazing has significantly altered the vegetation of many forest areas, leading to degraded scrub vegetation, and continues to be a threat to native vegetation, especially on those islands with significant numbers of free-roaming sheep and goats, such as Bonaire, Carriacou, Petit Martinique and St. Barts, and many offshore cays that have been traditionally used as natural corrals for goats. Unfortunately, agricultural expansion has resulted in unacceptable levels of cultivation and grazing on unsuitable land (Rojas *et al*. 1988) that has led to soil erosion, further land degradation and landslides that cause substantial economic losses each year and are especially damaging on steep islands with flat coastal plains such as Hispaniola and Jamaica (see Box 1).

Most of the Caribbean's forests have been lost to agricultural development, and today no more than an estimated 23,000 km^2 or approximately 10 percent of the original vegetation remains in a pristine state in the Caribbean Islands Hotspot (CI 2009). Cuba possesses the largest remaining tracts of forest in the Caribbean but these still represent only 24 percent of the original area (FAO 2006a, 2009) and a significant part of this comprises reforested land.

Box 1. A Tale of Two Countries – Forest Loss on Hispaniola

The lowland forests of Hispaniola were converted to sugarcane plantations between 1630 and the 1880s, which was followed by the destruction of montane forest as many freed slaves established themselves in the mountains following the abolition of slavery. However, even in 1925, Haiti was considered lush with 60 percent of its original forest cover, but since then the population, which is now more than 9 million, has cut down all but about 2 percent, with the largest remaining blocks being in the Massif de la Hotte and Massif de la Selle key biodiversity areas. In the process fertile farmland soils have been destroyed and there is severe erosion in the mountainous areas, which has led to land degradation with watercourses laden with sediment and erratic water flows with periodic (and often catastrophic) flooding in the lowlands. In addition, invasive species, such as molasses grass, have frequently taking over abandoned land. As a result, today Haiti is one of the most environmentally degraded countries in the world.

On the other side of the border, the Dominican Republic still has about 10 percent of its land forested, and it appears to have stabilized the rate of loss of its forests (FAO 2006a). However, its forests continue to be threatened. Its rain and cloud forests are subject to shifting (slash-and-burn) agriculture, and the remaining areas are fragmented and widely dispersed through the country, its dry forests have been altered considerably by charcoal production and very few pristine areas are left. The country's remaining pine forests have also been subject to indiscriminate logging and clear-cutting. Furthermore, reforestation with exotic pine species provides an unsuitable habitat for native species and species diversity is generally poor.

Global statistics on forest cover are compiled by FAO every 10 years. The most recent figures (for 2005) indicate that the majority of the hotspot's remaining forests are found in Cuba (2,713,000 hectares), the Dominican Republic (1,376,000 hectares), the Bahamas (515,000 hectares), Puerto Rico (408,000 hectares) and Jamaica (339,000 hectares) (FAO 2006). In the Lesser Antilles, there are regionally significant forest holdings on Guadeloupe (80,000 hectares), Dominica (46,000 hectares) and Martinique (46,000 hectares), although as in the case of the Greater Antilles, the best preserved tracts are at higher, less-accessible, elevations. Total forest cover of the insular Caribbean amounts to 5,747,000 hectares, or 26 percent of the land area (FAO 2006). The FAO figures show that forest cover is still declining in some of the hotspot countries (particularly Haiti and Jamaica), holding steady in others (particularly the Leeward Islands and Dominican Republic), and increasing in only a few (Cuba, Puerto Rico, and St. Vincent and the Grenadines). However, these conclusions need to be treated with caution, as there are differences between authorities on what constitutes "forest," and no reliable systems of monitoring are in place in most Caribbean countries. For example, Jamaica's Department of Forestry has published work contesting FAO's figure and maintaining that the rate of loss of Jamaica's forests during the 1990s was virtually negligible (Evelyn and Camirand 2003)

Although clearance for agriculture has been one of the greatest threats to native forests in the insular Caribbean, declines in some agricultural markets has led to the abandonment of degraded areas with an expansion of secondary forest, which often still has good biodiversity value and can be of critical importance for ecosystem services. Secondary forests provide important ecosystem services, with protection of watersheds and provision of water supply and fuelwood being

particularly important in the Caribbean, and could potentially provide important opportunities for carbon capture as part of climate change adaptation and mitigation strategies. However, to date, forest conservation efforts have largely focused on the remaining areas of primary forest, and secondary forest areas and abandoned agricultural areas are frequently targeted by planners for development as they are perceived to have much less importance (Massol González *et al*. 2006).

Inappropriate land-use practices are unfortunately common in the region and the root cause of much erosion, pollution and sedimentation that threaten both the marine, as well as terrestrial, environment (Burke and Maidens 2004). Such practices and can also increase the likelihood of fires.

Extensive areas of freshwater wetland habitat in the Caribbean, such as marshes and ponds, have also been drained and reduced due to agricultural schemes or degraded through overgrazing by livestock, although accurate recent figures for the area of wetland lost do not exist. A survey of 220 Eastern Caribbean coastal wetlands (predominantly mangroves) between 1989 and 1991 revealed that virtually every site visited in the 16 islands showed evidence of damage, and more than 50 percent showed severe damage (Bacon 1993). In addition, uncontrolled development of aquaculture has resulted in loss and degradation of wetland habitats in some coastal areas, including coastal lagoons and mangroves in some countries.

Over-Exploitation of Natural Resources

The main activities that constitute threats in this category include unsustainable hunting and egg collecting, over-collection of wood for fuel, trapping of animals for the pet and aquarium trades, collection of plants for horticulture and timber extraction. A full list of which species are exploited is not available and there have been no regional overviews. Furthermore, quantitative data on many of these activities are scarce in part because exploitation is often illegal and not adequately monitored due to lack of resources in the relevant agencies. Consequently, it is difficult to gauge the true impact of these activities relative to other threats, but they are considered significant for some species.

Hunting

Many species of animal are hunted for food or sport in the region. Species hunted for food (or for sale as food) include many threatened species of amphibians, reptiles, birds and mammals. Amphibians include the globally threatened mountain chicken on Dominica and Montserrat; reptiles include marine turtles (especially adult females and eggs), and iguanas (Haiti, Dominican Republic and the Lesser Antilles); and mammals include hutias (Capromyidae). Many species of birds are hunted for food, particularly waterbirds and game birds, including threatened species such as West Indian whistling-duck (*Dendrocygna arborea*). Hunting of birds for sport, especially pigeons and doves, such as white-winged dove (*Zenaida asiatica*) and Zenaida dove (*Zenaida aurita*) in the Greater Antilles, is popular on many islands, but unfortunately some target species that can be legally hunted in some countries are becoming scarcer, such as. the white-crowned pigeon (*Patagioenas leucocephala).*

Egg Collecting and Harvesting for Medicinal Properties

Seabird colonies on offshore cays throughout the Caribbean have also been traditionally harvested for their eggs by fishermen during the breeding season, and, although most colonies are now protected under national legislation, illegal egg collecting still occurs. On Hispaniola, the sooty tern colony at Isla Alto Velo was estimated at 175,000 pairs in 1950 but had dropped to 40-50,000 pairs by 1980, which has been explained by systematic large-scale egg robbing by humans (Keith 2009). Egg collecting still occurred on islets off Grenada in the early 1990s and still occurs

in the Grenadines (Frost *et al*. 2009). The collection of sea turtle eggs is intensive and pervasive throughout the Caribbean Islands Hotspot. Some islands report egg poaching levels approaching 100 percent on some beaches. The exploitation is largely unquantified, and its impact on turtle populations is impossible to judge (Bräutigam and Eckert 2006).

Some threatened or endemic animals are also shot or collected for medicinal use. These include the rufous-breasted cuckoo (*Hyetornis rufigularis)* on Hispaniola and the clouded boa or "tete-chiens" (*Boa onstrictor nebulosus)* on Dominica, which is collected by locals who believe the fat under the skin, used to make "snake oil," helps cure joint problems and back ache. Medicinal oil is obtained from leatherback turtles in several Caribbean islands (J. Horrocks *in litt*. 2009).

Timber Extraction

Originally, hardwood was used to construct ships (and Carib communities on Dominica still cut large hardwood trees for canoes), homes and furniture by the early colonists, and the rest of the forest was treated as a source of fuelwood and then burned for plantations. Today, few of the islands have any significant primary forest cover, and a number of species that were once common and heavily traded are now commercially exhausted. These include Caribbean mahogany (*Swietenia mahagoni),* which has been lost from portions of its range with its old growth stands virtually eliminated and is now listed as Endangered and restricted in international commercial trade under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Because of its value, this species was introduced elsewhere and has now become naturalized on many islands. Other economically valuable timber species in the Caribbean Islands include walnut (*Juglans jamaicensis*) (listed as Vulnerable), West Indian ebony (*Brya ebenus*) and poui (*Tabebuia heterophylla*). Illegal logging threatens commercial forest concessions and critical protected areas and buffer zones.

Firewood Collection and Charcoal Production

Because energy infrastructure in rural areas of the poorer countries in the hotspot is still poorly developed, communities in these areas rely heavily on fuelwood and charcoal from neighboring forested areas, including mangroves. In Haiti, fuelwood provides the main source of household energy charcoal and fuelwood currently provide 75 percent of Haiti's energy consumption (Smucker *et al.* 2007), and 80 percent of wood extracted in Jamaica is ultimately consumed as fuelwood (FAO 2001). A range of approaches have been tried to address this problem. Cuba, for instance, has long suffered from an intermittent energy crisis, but daily 16-hour electricity cuts in 2004 encouraged the government to pursue a policy of energy conservation drives, a review of the electricity grid and increased use of solar and wind power, which is likely to have had a knock-on effect of reducing the demand for fuelwood from native forests.

It is recognized that addressing the lack of energy sources for poorer rural communities can help reduce fuelwood collection and take pressure off the remaining forests and its threatened biodiversity. In the Dominican Republic, for instance, a government policy of subsidizing propane gas and cooking stoves was set in place in the mid-1980s, which helped reduce the consumption of wood for charcoal used for cooking by most of the population, from 1,596,000 sacks in 1982 to 26,465 sacks in 2000 (Gomez 2001). More recently, there have been efforts to promote energy efficient wood-burning stoves in the Dominican Republic.

In some countries, such as Haiti, cutting of mangroves for charcoal and firewood has become more common as more traditional and accessible timber reserves have become exhausted. Unfortunately, loss of mangrove forests makes the coast more vulnerable to erosion from storms, and destroys essential nursery areas of many commercially important fisheries and coral reef species, such as lobster and parrotfish (CEP 2003, Mumby *et al*. 2004). Mangroves also buffer the

near-shore marine environment from many land-based impacts, such as nutrients, pollution and sediments. While awareness of their ecological importance has increased considerably during the past 20 years and appropriate management measures have been introduced, mangrove forest continues to be lost.

Collection of Non-Timber Forest Products

Non-wood forest products, such as fruits, fibers, resins, tannins, essential oils, tree seeds, honey, fodder, yam and bean poles, ornamental plants, tree fern trunks (for cultivation of orchids), bamboo, medicinal plants, spices, edible oils, dyestuffs, gums and mushrooms are often said to be an important part of the rural economy, especially for poorer families, but their value—socially and economically—has not been quantified and is only partially documented for some countries, e.g. Cuba and in the Windward Islands (John 2005). Cuba, for instance, lists production of 1,474t of raw material for medicine and aromatic products, 68t of raw material for colorants and dyes, and 18,400t of other non-edible animal products harvested from its forests in 2005 (FAO 2006). Collection of some non-timber forest products is known to be taking place at unsustainable levels or using destructive practices. In Haiti, *bois gras* is harvested by slashing the trunk of a mature pine under conditions of heavy sap production and collecting the sap-laden chips for kindling. This kindling is sold primarily to urban households to start charcoal cooking fires. The tree is left standing but vulnerable to disease, fire and strong winds. *Bois gras* harvesting is a direct consequence of poverty and demographic change, and is leading to forest resource degradation, particularly in the key biodiversity areas of Massif de la Hotte and Massif de la Selle.

Collection for Live Animal and Plant Trade

Collecting for the pet, aquarium and horticultural trades, both local and international, is also believed to present a direct threat to some species in the hotspot particularly for the more attractive and rarer (so more commercially valuable) species, such as parrots, iguanas, orchids, bromeliads and cacti. Unfortunately, trade statistics for local markets are not generally kept (and protected species tend to be sold clandestinely) and most of the countries in the hotspot have not submitted recent annual and biannual reports on trade to CITES (exceptions being Barbados, Cuba, Jamaica and St. Lucia). As a result, national and international trade statistics for animals and plants are not comprehensive for the Caribbean.

A 2006 survey carried out by TRAFFIC found more than 23,000 items made from Critically Endangered hawksbill turtles (*Eretmochelys imbricate*) for sale. A February 2009 revisit to the same locations revealed a dramatic reduction with only 135 shell items (more than 99 percent withdrawn), which has been attributed to a widespread government-led action launched in November 2008. The Dominican Republic has encouraged the trade of alternative products, such as cow horn or bone, to present an alternative to shops trading in these turtle products.

Despite protection under national and international legislation, small numbers of threatened species continue to surface in markets outside the region. For instance, several specimens of St. Lucia amazon (*Amazona versicolor*) and Cuban amazon (*Amazona leucocephala*) have been reported in EU countries in recent years despite both being EU Annex-A/CITES Appendix-I listed (Anon. 2002 quoted in Theile *et al*. (2004). There has also been concern over illegal trade in the U.S., U.K., French and Dutch overseas territories in the region. However, the scale of illegal smuggling of Caribbean wildlife is not known.

Mining and Energy Production

Mining

Extensive loss of natural habitats has also occurred due to mining activities in some countries. This is most notable on Jamaica, where significant areas, particularly native forest, have been lost in central parts of the country to bauxite mining and limestone quarrying, and further largely pristine tracts of wet limestone forest are threatened.

Bauxite/aluminum is Jamaica's principal mineral export and accounts for around 10 percent of GDP and Jamaica is the third largest producer of bauxite in the world after Australia and Guinea. Deposits underlie around one quarter of the island's surface. Unfortunately, bauxite mining is considered to be one of the most significant reasons behind deforestation in Jamaica. The open-cast mining operations not only destroy forest and other surface habitats but also cause caustic soda contamination of water courses impacting freshwater biodiversity, and air pollution due to bauxite and alumina dust. In recent years there has been particular concern about the expansion of Jamaica's bauxite industry into the Cockpit Country, which supports the largest remaining area of intact wet limestone forest in Jamaica. Cockpit Country is the major aquifer for central-western Jamaica. Bauxite mining also occurs in Cuba and Hispaniola, although nickel, cobalt, iron and copper from Holguin province are Cuba's main mining products.

The region's mining industries have a patchy record of meeting their requirements to "restore" lands devastated by mining (and governments have a similarly poor record of enforcing the penalties for failure to do so), and environmental impact assessments are little more than paper exercises in many countries. Moreover, restoration attempts have not been very successful in repopulating areas with native species (common, widespread, usually weedy species tend to dominate), and, given the long history of mining in the region and continued importance of the mining sector to the national economies of some of the high-biodiversity countries, ecological restoration of mine workings remains a priority.

Apart from direct damage, mining activities in the Caribbean have also opened up the access to previously remote areas, which has led to movement of people into these areas and increased small-scale agricultural developments, especially slash-and-burn agriculture, illegal hunting, collection of fuelwood and production of charcoal.

There has also been an increase in illegal extraction of gravel from riverbeds and sand from beaches for the construction of hotels, resorts and residential houses, practices which are common and widespread in the Caribbean islands. Apart from destroying turtle and seabird nesting areas and unique littoral fauna and flora communities, beach sand mining causes sedimentation, and disturbs the hydrology, which has negative impacts on neighboring coral reefs and other marine ecosystems. Unfortunately, these activities tend to be localized and small-scale and are difficult to monitor and police, although their cumulative impact is thought to be significant.

Energy Production

The insular Caribbean relies heavily on imported petroleum for its energy (90 percent of all energy used) and there are no significant coal deposits on the islands. Wind (e.g. in Barbados), hydro (in Dominica, Dominican Republic and St. Vincent) and solar energy are seen as potential alternative sources of energy. Installation of such energy farms does involve a certain amount of habitat destruction. Wind farms may represent a threat to bats and both migratory and resident birds, which may be vulnerable to injury and death from wind turbines blades. Consequently, the siting of future wind facilities is critical and needs to ensure that thorough environmental impact

assessments are undertaken in all cases. For example, a proposed wind farm in the Karso del Sur Important Bird Area in Puerto Rico could destroy 5 percent of the global population of the Critically Endangered Puerto Rican nightjar (*Caprimulgus noctitherus*) because of accidental collisions with the wind turbines.

Pollution

The main sources of pollution in the insular Caribbean are sewage and wastewater from urban sources (often untreated or insufficiently treated), excessive pesticide and nutrient additives from agricultural activity, discharges and accidents involving heavy metals and oils from industrial facilities, and dumping of solid waste from a variety of sources in mangroves, drainage channels, rivers and other wetlands. Eutrophication is also caused by the disposal of large quantities of waste from sugarcane extraction on some islands, which is dumped into drains and rivers. Waste management and disposal capability is very limited in the insular Caribbean countries, and as a result, pollution of coastal areas is a major threat to coastal biodiversity. Waste management is considered to be one of the major environmental issues in the CARICOM region (CARICOM Secretariat 2003).

Figures for overall pollution loads of soils and rivers in the region are not available due to inadequate monitoring on most islands, and their impact on terrestrial ecosystems and biodiversity is poorly known, so it is difficult to evaluate how serious this threat is in relation to other threats. Much more research has been focused on the impact of pollution on the marine environment, where municipal, industrial and agricultural wastes and run-off account for as much as 90 percent of all marine pollution in the region (CEP 2003, Heileman and Corbin 2006). Pollution is also recognized as having significant socioeconomic impacts in the region, including on human health (UNEP 2004a, b).

Geological Events

There are about 30 active or potentially active volcanoes in the Lesser Antilles (volcanic activity no longer affects the northern part of the region directly) but major events in the last 100 years have only taken place on the major peaks of Guadeloupe, Martinique and St. Vincent, and most recently on Montserrat, although the eruption on Martinique in 1902 was responsible for the extinction of an endemic rodent *Megalomys demarestii*. Following a major eruption, the vegetation takes several decades to return to an appearance of normality. Interestingly, the vegetation close to permanent active fumaroles and sulfur springs, such as on Montserrat, Dominica and St. Lucia, is specialized and limited to a few sulfur-tolerant species such as *Clusia* and *Pitcairnia*.

Root Causes and Barriers

There is a complex mix of interacting socioeconomic, political, cultural and environmental factors and driving environmental change and threatening biodiversity in the insular Caribbean. Principal among these are increasing population and material consumption, poverty and inequitable access to resources, the inherent economic and environmental vulnerability of the islands to external forces such as changes in global trade regimes, and climate change. Some of these, such as poverty, are local or national issues, whilst others, such as climate change, require attention at the global level to solve. All these drivers can be either exacerbated or mitigated by public policies and institutional arrangements, at national, regional and international levels. The following section presents a brief overview of these major root causes and barriers.

Root Causes

Population Growth and Movements

At a fundamental level, many trends affecting biodiversity and ecosystems in the insular Caribbean are a reflection of the limited land available for an ever-increasing number of users. The Caribbean islands have some of the highest population densities in the world. The current population stands at around 38.4 million (mid-2007 figure) and the population of most countries in the region is expected to increase over the coming decades to around 44 million in 2025 and over 48 million in 2050 (Population Reference Bureau 2008), with some countries facing a substantial population rise, e.g. Haiti (see Section: *Demographic Trends*). These increases are due to both natural population growth and inter- and intra-country migration but the significance of these vary between countries.

All countries are witnessing rapid rates of urbanization and migration from rural to urban areas, resulting in increased demands for natural resources, particularly for water and energy, and land for building, with increased problems associated with waste management and sanitation. These demographic changes have increased the concentration of people in ecologically sensitive areas, particularly coastal zones and mountain slopes, and led to severe environmental degradation in some countries (see Box 2). The islands' relatively high population densities also mean that there is the potential for conflict over scarce resources, especially over land (as well as water in the drier islands), particularly in the coastal zone.

Rapid Economic Growth and Increasing Consumption

Along with increasing populations, many countries in the region have seen a rise in GDP and average incomes in recent decades with the rise of a middle class that has generated demand for developed world goods and lifestyles. Along with increased trade (which has increased the incidence and risk of introduction of invasive alien species), this has led to increased pressure on land for housing and urban development, and environmental services, particularly for energy and freshwater. In the case of water, particularly reliable provision of clean water, demand is exceeding the natural supply capacity, caused in part by the huge needs of the agricultural and tourism sectors, and by a reduction in supply, quality and reliability as a result of upper watershed forest conversion, pollution and soil erosion. Agriculture is the largest consumer of water in the Caribbean, and accounts for more than 90 percent of the total water used in Haiti. The tourism sector also consumes enormous amounts of water, however, the countries that experience the highest rates of water scarcity (the low limestone islands of the eastern Caribbean where rainfall is highly seasonal (Heileman, 2005)) are also among the most attractive for mass tourism. By international standards, Barbados, Antigua and Barbuda and St. Kitts and Nevis are already considered "water-scarce" countries (a water supply below 1,000 m^3 per capita per year, UNEP 2008). Changes in rainfall pattern and pronounced periods of localized drought associated with climate change are expected to only increase water stress.

Poverty and Inequity

Apart from Haiti, the Caribbean islands are all middle- to high-income countries. However, there are high levels of economic inequity in some countries. Poor people in the Caribbean often depend directly on natural resources, but are frequently forced to use them unsustainably because of immediate survival needs. Consequently, poverty is considered a root cause of biodiversity and ecosystem loss and degradation on many of the islands.

Lack of legal ownership of, and access to, land and resources are two of the key determinants of poverty in the Caribbean. In addition, poor groups and individuals are often displaced or

dispossessed by existing power structures and vested interests. Control over natural resources and their use has been, and remains, in the hands of the wealthy and powerful, including governments. Consequently, poor farmers and the rural communities have few alternatives to cutting down the remaining forests and growing subsistence crops on marginal erosion-prone lands or overexploit other natural resources for food and to earn essential cash for their short-term survival. Lacking technical support, agricultural practices on hillsides tend to be poor, resulting in low yields, increased soil erosion and disruption of hydrological systems (most dramatically demonstrated in Haiti, although the problem exists throughout the region), which after a short period leads to further demand for land with additional clearance of forests and other natural habitats. Furthermore, a lack of or unclear property rights acts as a disincentive to invest in sustainable land management practices. Given their reliance on biodiversity and ecosystem services, those most hurt by environmental degradation are usually the rural poor themselves.

Box 2. Population and Land Degradation in Haiti

Many of Haiti's rural poor population depend on subsistence agriculture for their livelihoods, and population pressure has led to an expansion of agricultural lands, notably for slash and burn agriculture, with the loss of a significant proportion of the country's native forest. With the increased population, Haiti has gone from more than 670 people/ km^2 of arable land in 1987 to more than 961 people per square km of arable land, which is the highest density pressure on arable land in the Western Hemisphere. Unfortunately, because of soil and climatic conditions, only 11.3 percent of Haiti's land area offers the potential for high agricultural yields and these productive lands (usually plains – 63 percent of Haiti has slopes of more than 20 percent) are often under-utilized or are lost because of residential development (frequently slum sprawl) or salinization. As a result, a high percentage of less productive cultivated lands are being used beyond their carrying capacity, resulting in a relentless process of land degradation. It is estimated that the equivalent of 6,000 hectares of all types of arable land is lost each *year* to erosion, an annual decline of 3 percent (Ehrlich *et al*. 1987). Also forest areas attract peasants from other regions in search of land, which is leading to degradation of forest resources. These represent the primary source of energy for Haitian people but less than 2 percent of its forest is now left and harvesting is continuing at an unsustainable rate. There are increasing numbers of encroachments, even within the Massif de la Selle and Massif de la Hotte key biodiversity areas, leading to their degradation. Extracted from Swartley and Toussaint (2006).

Policies and Incentives that Damage the Environment

With the exception of Cuba, governments in the Caribbean have followed the dominant (non-sustainable) global economic models, through policies based on export-orientated development, especially for agriculture, and, in recent years, provision of services, especially in the tourism and financial sectors. These development policies have failed to integrate conservation and resource management considerations in a systematic and participatory way. Associated with these policies have been economic incentives/subsidies, grants and financial arrangements to favored sectors, such as reduced tariffs on water and electricity, tax exemptions on investments and exports, subsidized prices on imported fertilizers and pesticides, and construction of transport and communication infrastructure to facilitate development, that have encouraged non-sustainable natural resource extraction and environmental degradation. For instance, government policy in many countries has been to expand tourism as a means of generating jobs and foreign exchange, and external investment has been pursued with developers frequently given favorable terms.

Dependency, Isolation and Inherent Vulnerability

The Caribbean islands, like other Small Islands Developing States (SIDS) worldwide, share a number of natural and anthropogenic features that make them particularly vulnerable to impacts from a wide range of internal and external forces that can threaten biodiversity and natural environments and constrain the pursuit of sustainable development (Griffith and Ashe 1993, Kaly *et al*. 2002).

Because of their small size, insularity and characteristics of their natural resource base, most countries are dependent on trade and external sources of energy, and consequently are exposed to external and global changes in trade and markets. For instance, many of the islands have traditionally been mono-crop economies, relying on preferential trade arrangements for their main exports. Some governments have sought to reduce dependence on monoculture agriculture by promoting agricultural diversification, however, there has been concern in some countries at the rates at which natural forests are cleared in response to the diversification thrust. Commercial barriers for Caribbean island exports to North America and Europe have increased in recent years, and the region's export markets have been threatened by large trade arrangements such as the North American Free Trade Association and the Economic Partnership Agreement and preferential markets, such as for bananas and rum, have been lost.

Many countries also have high levels of external debt but small taxable populations, which presents a challenge to their long-term economic viability. Their openness to external influences also makes them susceptible to diseases, such as HIV/AIDS, and alien invasive species. The islands are also vulnerable due to their ecological uniqueness and environmental fragility, and high susceptibility to natural disasters and global climate-related change. Preliminary classifications from the SIDS environmental vulnerability index, which measures ecological fragility and economic vulnerability, shows that 17 of the countries/territories can be classified as extremely vulnerable to highly vulnerable, four as vulnerable, and one as at risk, while none can be said to be resilient (see Table 11).

Table 11. Vulnerability of Some Insular Caribbean Countries According to the SOPAC Environmental Vulnerability Index

Extremely Vulnerable	Highly Vulnerable	Vulnerable	At Risk	Resilient
Barbados* Guadeloupe* Jamaica St.Lucia* U.K. Virgin Islands* U.S. Virgin Islands*	Cayman Islands* Cuba Dominican Republic Grenada* Haiti Martinique* Montserrat* Netherlands Antilles* Puerto Rico* St.Kitts and Nevis* St.Vincent and the Grenadines*	Anguilla* Antigua and Barbuda* Aruba* Turks and Caicos*	Bahamas*	None

- Environmental Vulnerability Index trends for countries that are data deficient.
- Data from www.vulnerabilityindex.net/ (accessed 5 June 2009) and see Kaly *et al*. (2005a,b).

Global Climate Change

Climate change is expected to become a major driver of environmental change in the Caribbean, and indeed it is already having substantial impacts (Magrin *et al.* 2007). Climate change is treated more fully in the next section of this report.

Barriers to Biodiversity Conservation

There are a number of constraints that need to be overcome to address the environmental threats outlined above and achieve more effective conservation of biodiversity and ecosystem services. The main ones discussed during the national workshops and consultations for this profile include poor land-use planning, limited capacity and lack of awareness of biodiversity and ecosystem services (particularly their value) among decisionmakers and the general public (see Table 12).

Poor Land-use Planning

Because many environmental problems and risks either derive from or are exacerbated by the pattern of human land use, the quality of urban and rural planning is often of critical importance for achieving environmental sustainability. On the small islands of the Caribbean with their dense coastal populations, inappropriate land use can have much more significant impacts on the environment than in larger states, and there is less room for error in land-use planning and management (Griffith and Ashe 1993). Land-use planning for agriculture, tourism, industry, forestry and urban development is still largely confined to their own sectors in the region with little consideration of the impacts of these plans on other economic sectors or the environment. Integrated land-use plans are uncommon in the insular Caribbean, and there are cases where such plans have been blocked. In addition, although the locations of many key biodiversity and ecosystem services sites have been identified through surveys and mapping exercises in recent years, this information is still not fully integrated into decisionmaking in planning processes, consequently ecologically important sites are still targeted for inappropriate developments.

Limited Capacity and Financial Resources

Although Caribbean island governments have made significant efforts to build institutional and individual capacity (in terms of staffing and financial resources) in the areas of biodiversity conservation, waste management, integrated watershed management, and climate change and disaster mitigation over the last two decades, the lack of adequate capacity remains and continues to be recognized as a major barrier to achieving effective environmental management and sustainable development. The need for capacity building within the ministries of environment around the region was highlighted as a major issue at the 7th Meeting of the OECS Ministers of Environment Policy Committee in 2003.

Table 12. Prioritized Barriers to Conservation in the Caribbean Islands Hotspot

BARRIERS	Average Prioritization Score (on a scale from 1–4)
Poor Land-Use Planning	3.8
Limited Capacity, Financial Resources	3.4
Lack of Awareness	3.3
Lack of Political Support	3.2
Weak, Ineffective Policy, Legislation	3.1
Inefficient Institutional Organization	3.1

Inadequate Participation in Decisions	2.9
Limited Information, Availability	2.8
Language, Culture	1.2

Note: Barriers were scored from 1 (insignificant barrier) to 4 (highly significant national barrier), for each of a broad cross-section of Caribbean countries (Haiti, Dominican republic, Jamaica, Bahamas and 4 Lesser Antillean nations). The average of these scores is presented as a "Caribbean" score.

Most of the island states have populations of less than 1 million people with small pools of skilled labor and very limited government budgets for spending on the environment sector, which seriously constrains capacity building efforts. This has a particular impact on staffing in government agencies. Individuals frequently seek higher education outside of the region due to limited opportunities for training in natural resource management and biodiversity conservation at universities in the Caribbean, often in the United States or Canada where many chose to remain due to better salaries and career development opportunities. If they do return, many then enter the private sector or seek employment in unrelated but higher salaried professions in the financial or legal sectors. Consequently, a "brain drain" from the Caribbean and staff retention by government agencies remain important issues affecting capacity. Even on the larger islands, the size of government environmental departments, in terms of manpower and financial resources allocated to them, is not sufficient.

A number of initiatives to assess capacity needs have been undertaken in the Caribbean in the last 10 years, principally supported through donor programs and projects. These include the GEF-funded National Capacity Self Assessments (NCSA), which have placed particular emphasis on identifying needs to meet obligations under the three Rio Conventions, and have been prepared for Antigua and Barbuda, the Bahamas, Dominica, Dominican Republic, Grenada, Jamaica, and St.Kitts and Nevis, with other countries at various stages in the process (Barbados is at the inception stage, Cuba and Haiti are engaged on the thematic analysis, and St.Lucia is completing its Action Plan). The need for capacity building is also highlighted in many of the NBSAPs, NEAPs, national protected area gap analyses, and other national strategies and plans.
Protected area management is also highlighted as generally weak in the Caribbean, which despite considerable investment in recent years by governments and external donors are still under resourced and many continue to be considered as little more than "paper parks" and threatened by invasions and illegal activities, as patrolling and enforcement actions are deficient. For instance, only 10 of the Dominican Republic's national parks have management plans (including the key biodiversity areas of Armando Bermudez National Park, Loma Quita Espuela, and Jaragua National Park), and only six of these have had some degree of implementation.

However, perhaps the biggest capacity issue is the lack of staff and resource among agencies tasked with the monitoring, surveillance and enforcement of existing national legislation and regulations governing biodiversity conservation and environmental management (such as monitoring and enforcing compliance with EIAs and planning restrictions), particularly given the continuing pressures from tourism, urban and industrial development in the region. Indeed in several countries (for example, Jamaica), policy and legislation is viewed as largely adequate but lack of enforcement and monitoring, as well as poor coordination between agencies, undermines the implementation of the law.

Lack of Awareness of Importance of Biodiversity and Ecosystem Services

As well as lack of knowledge, there is a poor awareness and limited understanding of the ecological, economic, social and cultural values of biodiversity, costs of its loss and its critical importance to human wealth and well-being among decisionmakers and the general public in the Caribbean. Even in relatively developed countries, such as Puerto Rico, the level of public awareness on local biodiversity is low. Some governments are taking a longer-term strategy with an emphasis on improving coverage of environmental issues in the national school curriculum. Barbados, for instance, has introduced environment and development concerns into teacher-training programs, while environmental education is an integrated part of primary- and secondary-level school curricula in the Bahamas. These initiatives will, in the long run, increase the proportion of the population with environmental awareness and interest, leading to a greater call for environmental issues to be properly addressed, and an increase in the overall pool of individuals with the technical skills required for biodiversity conservation.

Lack of Political Support

Although there have been a number of important regional environmental agreements, commitment among high-level decisionmakers is still not often translated into the necessary political support for biodiversity conservation. Short-term and frequently shifting national economic and political interests often take precedence over long-term local social and environmental impacts. This lack of political will is evidenced by continuing permission for destructive developments in ecologically sensitive areas, usually the result of strong lobbying by vested economic interests, especially the industrialists and land developers, who argue that environmental protection costs and safeguards will reduce international competitiveness.

Weak and Ineffective Policy and Legislation

Although there has been good progress on updating and harmonizing environmental policy and legislation in many states in the region in recent years, this process is still incomplete. For instance, legislation for private reserve establishment and co-management of protected areas is non-existent in most countries in the Caribbean. Also, while a few countries, such as Barbados and the French départements and U.S. territories have legislation specifically dealing with the coastal zone, many countries have no special instruments for regulating development in this ecologically critical area. Furthermore, there has been limited integration of biodiversity conservation and sustainable environmental management objectives into non-environment sector policy and legislation, and relatively little coverage in development and sector plans. Policy and legislation needs to be particularly tightened to better protect threatened species and protected areas (e.g. on Jamaica lack of clarity on definitions of protected areas hinders effective regulation).

In some cases, laws do not have clear regulations that provide guidance to developers, which is exacerbated by inadequate environmental codes and standards for land development, buildings, resource utilization, and waste treatment and disposal, which limits the ability of government authorities to enforce environmental protection. Furthermore, individual developments often taken place without adequate assessment of their impact on local environment and resources or knowledge of environmental carrying capacity.

Inefficient Institutional Frameworks, Networks and Collaboration

Previous assessments have also identified a number of weaknesses in institutional frameworks and operation that constrain the effectiveness of environmental management. Chief among these is that management authority for environment is frequently split between ministries and other statutory bodies and often responsibilities overlap or are unclear. This is exacerbated by a lack of

institutional mechanisms for coordination and collaboration. The lack of coordination and collaboration between governments and nongovernmental groups is paralleled by insufficient inter-donor collaboration at a national level. This has been identified as a significant issue in, for example, Haiti (Smucker *et al*. 2007) where heightened inter-donor collaboration at policy levels as well as the targeting of field interventions was seen as a critical need.

The prevalent view of the environment as a niche issue is reflected in the lack of integration of environmental objectives into broader sector policies and programs, which is partly a reflection of poor understanding of the linkages between biodiversity and ecosystem services and local livelihoods, employment and national economies among decisionmakers in non-environment sectors. This gives rise to politically weak and under-funded environment agencies and biodiversity conservation policy still being seen as incompatible with and restricting development policy, despite the presence of national sustainable development strategies in many countries that highlight the importance of biodiversity. However, attitudes toward the environment at senior level do seem to be changing, due to the increasing awareness and international profile of the impact of climate change, which is having a real effect in the Caribbean.

Inadequate Public Participation in Decision-making Processes

National and local governance frameworks for environmental planning and management vary greatly from country to country, but governments are generally highly centralized with often high levels of state control, especially in the smaller island states (Cuba as well). Although most recent national policy frameworks include provisions for private sector and public stakeholder participation in environment and development decisionmaking, such as National Sustainable Development Councils, and stakeholder participation is promoted under many regional and international initiatives in which Caribbean governments participate (Agenda 21 and the Barbados Programme of Action for Sustainable Development in Small Island Developing States encourage stakeholder participation in sustainable development processes), government consultation processes have been criticized for being largely "cosmetic" in many countries, with involvement of public stakeholders only at the end of processes when decisions have essentially already been made (CANARI, 2005). Consequently, there is a clear need to improve civil society participation in environmental decisionmaking and governance. The benefits of public involvement in decisionmaking are well documented (Borrini-Feyerabend *et al.* 2004).

Limited Technical and Scientific Knowledge and Poor Availability of Information Needed for Effective Decisionmaking

Although the Caribbean countries have shown major improvement in research and assessment of their living natural resources in recent years, considerable gaps in baseline data still exist and there is a often a lack of accurate, up-to-date information which limits effective evidence-based decisionmaking for biodiversity conservation, the ability to prepare effective land-use plans, EIAs and environmental monitoring, and complicates the enforcement of regulations. Information is also frequently scattered and difficult to access and with poor coordination/linkage between databases (even within governments), although there are some good regional reviews and attempts have been made to overcome some of these problems through the creation of national Clearing House Mechanisms (see www.cbd.int/chm/network/?tab=3) for biodiversity data under the CBD and regional data-gathering programs such as the Inter-American Biodiversity information Network (www.iabin.net/).

CLIMATE CHANGE ASSESSMENT

Although Small Island Developing States (SIDS), including those of the Caribbean, are responsible for less than 1 percent of total annual greenhouse gas emissions, they are among the most vulnerable in the world to the projected impacts of climate change, such as rising sea levels, intensifying storms, mass coral bleaching events and potential water and food shortages (UNEP 2008, Lewsey *et al*. 2004).

Climate in the Caribbean has already begun changing following the pattern observed globally and elsewhere in the Northern Hemisphere. Temperatures and the frequency of extreme weather events, such as hurricanes and droughts, have already increased in the region (Futuro Latinoamericano 2008), and there is particular concern over predicted sea level rise. Given that the Caribbean states contribute insignificant amounts of greenhouse gases to the global total, their main priority in addressing climate change is to formulate and implement appropriate strategies for adaptation to minimize the social and environmental impacts of climate change. Adaptation may be defined as adjustments of natural or human systems in response to actual or expected climatic stimuli, or their effects or impacts, that moderates harm or exploits beneficial opportunities associated with climate change (IPCC 2001).

Climatic History and Projections

Climatic History

The Caribbean's past climatic history has been a significant influence in the evolution of its biota. During the Pleistocene ice ages the environmental conditions in the Caribbean were dominated by arid savannah, grassland, and xeric scrub forests, which is quite different than the present mesic conditions. Sea levels were about 125 m lower than they are today (Fairbanks 1989). The Caribbean islands had substantially greater land masses with islands much closer together or even connected by land bridges. As a result, there was probably much more movement of terrestrial species between islands than occurs today. However, as sea levels rose following the ice ages, populations became isolated and ranges contracted, resulting in genetic differentiation among populations and eventually speciation (Pregill and Olson 1981). Thus, these periodic changes in sea level resulting from natural global warming and cooling have been a factor behind the high diversity of species and levels of endemicity that exists in the Caribbean islands today.

Projected Climate Change at the Hotspot Scale

Climate change is projected to have profound effects on the Caribbean Islands Hotspot in terms of increasing air temperature, changes in rainfall patterns and quantities and rising sea-levels. The projections for each of these variables (mostly presented in the form of ranges with probability factors attached) are outlined below.

The Intergovernmental Panel on Climate Change (IPCC) predicts that temperatures in the Caribbean will rise between 1.4 ºC and 3.2 ºC by the end of the 21st century. Other estimates give a similar range e.g. the PRECIS Caribbean Climate Change Project predicts an increase of 1ºC to 5ºC in the Caribbean by the 2080s (Futuro Latinoamericano 2008). The north-western countries (Cuba, Jamaica, Haiti and the Dominican Republic) are likely to experience the greatest warming. CANARI estimates that there is a two-thirds probability of drought in the Greater Antilles in June, July and August (Day 2009). In general, rainfall is anticipated to decrease throughout the Caribbean, particularly in the summer wet season, except in the southern Bahamas and western Cuba. At the same time, hurricanes are predicted to become more severe with increased precipitation and higher peak wind speeds (Day 2009).

Projections of sea-level rise in the Caribbean range from 0.18 to 0.59 m (Day 2009) to 0.5 to 1.4 m (Rahmsdorf 2007) by the end of the 21st century (Day 2009). Sea-water temperatures are also expected to continue to increase (Futuro Latinoamericano 2008). The IPCC expects a rise in temperature of 1.4ºC to 3.2 ºC for the Caribbean by the end of the 21st century (IPCC 2007).

Impacts

Several areas in the Caribbean are considered to be especially at risk from the impacts of climate change. These include the hillsides of Hispaniola, particularly Haiti due to the threat of land and mud slides; coastal areas of island states such as Jamaica; and low-lying areas that are particularly flood-prone, including the island of Grenada and small islands that lack economies of scale, which includes many of the Lesser Antilles (Futuro Latinoamericano 2008). Changes in biodiversity and ecosystems in response to climate change are predicted to be considerable in the Caribbean, as a result of sea-level rise, increased temperatures, the greater severity of hurricanes and decreased precipitation (UNEP-WCMC 2009a, Lee and Jetz 2008).

Impacts on Montane and Forest Ecosystems

Montane habitats are expected to be reduced in size as they shift upwards in altitude due to temperature increases, or to disappear completely if they are unable to shift any further in elevation (UNEP-WCMC 2009a). Predicted decreases in precipitation will also impact montane systems, such as the Caribbean's elfin forests that are dependent on high moisture levels (UNEP-WCMC 2009). Caribbean elfin forests, or cloud forests, generally occur above 1,500 meters in elevation and are characterized by heavy rainfall and moist conditions. The Blue and upper Port Royal mountains of Jamaica, the upper elevations of Puerto Rico's El Yunque, Mt Scenery in Saba, and mountain peaks such as Pico Duarte (Cordillera Central Corridor) in the Dominican Republic all support elfin forest.

Increased storms, particularly more intense hurricanes that damage or bring down trees, and predicted increases in the frequency of droughts and/or flooding that cause changes in soil-water availability, are likely to significantly impact Caribbean forest ecosystems (Lewsey *et al*. 2004). Higher temperatures and greater periods of drought could also lead to increased risk of fires, which pose a threat as most Caribbean forest types are not fire-adapted (Lewsey *et al*. 2004). While hurricanes are natural events in the Caribbean and native forests are adapted to these events to some extent and usually eventually recover, any increased intensity of hurricanes may reduce the resilience of the region's forests (Walker and Salt 2006, Day 2009). For example, gaps in forests resulting from storms increase susceptibility to further wind damage. Future storms may have a devastating impact from which forests may find it difficult to recover, especially given that most Caribbean forests are already degraded and fragmented (Suárez *et al*. 2008).

Impact on Coastal Ecosystems and Wetlands

Coastal biotic zones, including estuaries and coastal lagoons, beaches and sand dunes, and mangroves and other near-shore habitats, are likely to be highly impacted by sea level rise and/or saltwater intrusion, and as a result are expected to lose productivity and suffer species loss. For each centimeter of sea level rise, thousands of hectares of land are predicted to be lost as the shoreline retreats by several meters (Lewsey *et al.* 2004). This is a problem throughout the Caribbean, though the Bahamas, where more than 80 percent of the land surface is a meter or less above sea-level, may be particularly impacted. Increased hurricane intensity will only add to the problem, as greater storms surges and severe flooding will further erode coastal shorelines and habitats. Saltwater intrusion into freshwater ecosystems is another predicted consequence of climate change, and is likely to be a particular problem on the smaller low-lying islands.

Many coastal areas and wetlands in the Caribbean are likely to be impacted by multiple effects of climate change. For example, in Cuba the Ciénaga de Zapata wetland, the largest wetland in the hotspot, may be reduced by up to 20 percent by the end of the century due to sea-level rise (Grogg 2008). Hurricanes, which are expected to increase in intensity as a result of climate change, greatly impact the wetland, and a 30 centimeter rise in sea-level would also threaten freshwater areas in the wetland due to saltwater intrusion (Grogg 2008).

While many areas of natural habitats have already been severely degraded and fragmented, which reduces their resilience, responses will vary according to species, habitat type and location. Some mangroves may be able to withstand sea-level rise, depending on sediment accretion and tidal range, while others may not if coastal development restricts their movement inland (UNEP 2008, Day 2009). Red mangroves account for about 50 percent of the mangrove coverage in the Caribbean, and require an average of 10 years to regenerate from storm damage. An increase in the frequency of tropical storms due to climate change could mean that the mangroves will potentially no longer have the time they need to regenerate between two weather events. While some mangrove species may expand their geographical range in the Caribbean as temperatures increase (Day 2009), in general mangroves are considered at risk and 10-15 percent of mangroves could be lost as a consequence of climate change (UNEP-WCMC 2009a, Alongi 2008). With a 1-meter sea-level rise, 3 percent of Cuban mangrove forests and 100 percent of the Port Royal wetlands in Jamaica are projected to be lost (UNEP 2008). Ironically, mangroves provide numerous benefits that reduce the impact of climate change on coastal and other habitats, including reducing storm surges and flooding impacts, and stabilizing soils and sedimentation.

Climate-Sensitive Species and Biotic Consequences of Shifting Climate

Caribbean montane species are particularly vulnerable to climate change because they cannot adjust by moving to higher altitude beyond a certain point (i.e. the summits of the few Caribbean mountain peaks). Shifts in species ranges to higher elevations have already been observed in North America, Asia and Europe (UNEP-WCMC 2009). Specialized ridge-forest tree species along the ridge of the Blue Mountains in Jamaica, for instance, could face extinction with climate change. Studies have concluded that some montane-specialist amphibian species have become extinct due to climate change, and such extinctions are predicted to increase. Indeed both reptiles and amphibians, which show very high levels of endemism in the Caribbean, are likely to be at particular risk from warming and drying trends due to their low tolerance of thermal changes, and in the case of most amphibians their need for moist environments (UNEP-WCMC 2009). Species with existing small distributions will be at high risk. For example, endemic parrots on several islands, whose numbers had been sharply reduced by loss of forest due to clearance for agriculture and timber extraction, have been brought to the edge of extinction following hurricanes that further destroyed forest cover (notably Hurricane David in 1979 which destroyed much of the habitats of the two endemic parrots of Dominica—the Endangered imperial Amazon (*Amazona imperialis*) and the Vulnerable red-necked Amazon (*Amazona arausiaca*)—nearly extirpating the former and reducing the latter to a fragment of its former range) (Suárez *et al*. 2008). However, it is not only restricted-range species that will be affected by climate change in the Caribbean. Sea turtles, which are already threatened by pollution, hunting and fishing throughout the Caribbean, are predicted to lose nesting habitat (beaches) due to sea-level rises and erosion from storms and hurricanes (Day 2009).

Climate change, particularly changes in temperature and rainfall patterns, may also lead to the establishment of new diseases in the region or exacerbate existing ones that previously were not a problem (Ostfeld 2009) and poses a potential threat to native biodiversity. For example, there is evidence from Puerto Rico that climate change, particularly drought, will worsen the impacts of the emerging infectious disease chytridiomycosis on amphibian populations in the Caribbean

(Burrowes *et al*. 2004). Researchers suspect that drought conditions cause the normally territorial frogs of the genus *Eleutherodactylus* to clump together into humid retreat sites, which are sparse during periods of drought, facilitating disease transmission and more lethal infections.

Just as changes in biotic zones have an effect on the species that live within them, changes in species compositions impact ecosystems and even climate change. Reductions in species richness can influence ecological processes that sustain biotic zones and ecosystem resilience, and can impact processes such as carbon storage, which subsequently affects climate change (UNEP-WCMC 2009a, Bunker *et al*. 2005, Walker and Salt 2006).

Existing Protected Areas in the Context of Climate Change

Protected areas are the primary repositories of terrestrial biodiversity in the Caribbean and provide essential ecosystem goods and services for human populations including ameliorating some of the impacts of climate change. Forested protected areas provide clean water supplies, micro-climate regulation and sequestration of carbon, while also preventing flash floods and reducing soil erosion and mudslides. Mangrove areas protect coasts from storm surges and reduce soil and sediment loss. Studies have shown that more intact and diverse ecosystems are more resilient to climate change (CAN International 2009, Walker and Salt 2006).

Well-managed terrestrial (and marine) protected areas can improve the state of biodiversity and increase its resilience to climate change and other disturbance and therefore have been promoted as a key adaptation strategy (Day 2009). The Millennium Ecosystem Assessment also cites climate change as one of the most important direct drivers of global biodiversity loss and changes in ecosystem services, and that biodiversity, which underpins ecosystem services, provides a critical climatic regulating function, thus benefiting human well-being.

Many of the 262 key biodiversity areas identified for this region are at risk due to climate change, while others may help to ameliorate the effects of climate change. Areas at high elevations, such as peaks in the Dominican Republic, Haiti, Jamaica, Cuba, Guadeloupe, Dominica, Martinique, Puerto Rico, Cuba, St.Vincent and the Grenadines, and St.Kitts and Nevis, are likely to be severely impacted by climate change, as it will be difficult or impossible for species living in these mountain areas to migrate upwards in elevation. Examples of key biodiversity areas with high-elevation elfin forests include the Blue Mountains Key Biodiversity Area in Jamaica and the Armando Bermudez National Park Key Biodiversity Area in the Dominican Republic (within the Cordillera Central Corridor). Coastal key biodiversity areas (for example, those identified as important sea-turtle nesting beaches) are also at risk, primarily due to sea-level rise. In some areas infrastructure may not allow for any species movement, while in others coastal key biodiversity areas and the species within them may be able to migrate inland. The establishment of corridors may help to alleviate some of the impacts of climate change for coastal key biodiversity areas.

Expected Impacts on Human Populations

Climate change is expected to cause significant impacts to human societies in the Caribbean, with small economies especially vulnerable (UNEP 2008). Like other SIDS, the economies of the Caribbean islands are heavily tied to natural resource-based activities, notably tourism, fishing and agriculture, and climate change is therefore likely to heavily impact these sectors (see Table 13, UNEP 2008).

With populations, agricultural lands and infrastructures tending to be concentrated in the coastal zone, any rise in sea-level will have significant and profound effects on settlements, living conditions and island economies. As agriculture is forced to move inland and uphill, there is a potential for huge negative impacts on the remaining biodiversity in these new agricultural areas.

The very survival of some low-lying islands is threatened. A measure of their vulnerability is given by the ranking of six Caribbean states among the top 40 countries in the world affected by extreme weather events such as hurricanes and floods in 2007 (Germanwatch Global Climate Risk Index, 2009). In another study of 80 developing countries by the World Bank, four of the top 10 countries most impacted by climate change (in terms of land area impact) were in the Caribbean (World Bank 2007). The Bahamas ranked number one, followed by Puerto Rico (fifth), Cuba (sixth) and Jamaica (ninth) (World Bank 2007). The Bahamas also ranked in the top 10 countries for climate change impacts on populations, GDP and urban areas (World Bank 2007). Both Jamaica and the Bahamas are in the top 10 countries with wetlands predicted to be most impacted by climate change (World Bank 2007).

The impact of the four consecutive tropical storms/hurricanes that affected Haiti and Cuba in 2008 demonstrated the region's existing vulnerability to weather-related hazards, and illustrates the importance of good environmental management and adaptation in dealing with climate change. The striking difference in the scale of the human loss and damage to infrastructure in these two countries reflects Cuba's more extensive adaptation planning and forest conservation measures (Suárez *et al*. 2008, Day 2009). Similarly, Hurricane Jeanne hit several Caribbean islands in 2004, but the number of flood-related deaths was more than 3,000 in Haiti versus 20-30 in all other impacted countries, due in large part to Haiti's highly degraded and flood responsive watersheds (The World Bank 2009).

Additional pressures from growing human populations and the very limited areas of available land suitable for economic activities contribute to the socioeconomic vulnerability of the Caribbean region. Specific socioeconomic impacts (UNEP 2008) are likely to include:

- Deteriorating coastal conditions, such as beach erosion and coral bleaching, are expected to adversely affect local resources (e.g. fisheries) and reduce their value as tourist destinations.
- Increased floods, storm surges, erosion and other coastal hazards, exacerbated by sea-level rise and that threaten vital infrastructure, settlements and facilities.
- A reduction in freshwater resources due to reduced precipitation, saltwater intrusion and sea-level rise, to the point where they cannot meet demand during low rainfall periods.
- Economic losses from reduced agricultural yields through a shortened growing season, drought, floods, increased erosion and increasing storm damage.
- Increase in the distribution and incidence of diseases, particularly insect-borne diseases such as dengue fever and water-borne diseases such as cholera, and malnutrition resulting from interruptions in agricultural production and food distribution.

Table 13. Summary of Key Issues and Impacts in the Face of Climate Change in the Caribbean

Issue or Resource Vulnerable to Climate Change	Potential Effect of Climate Change	Impact on Global Commons	Sectors at Greatest Risk	Comment on Impact
Freshwater availability	Reduced precipitation; increased evaporation and saline intrusion from sea-level rise	Endemic coastal and near coastal habitats	Water resources; tourism; agriculture; forestry	Water supply is anticipated to be a bottleneck for economic activity and a serious health concern. All water-using sectors would be affected. Groundwater salinization is likely in low-lying areas.

Degradation of marine and coastal ecosystems	Sea-level rise, changes in sea temperature and pH can affect ecosystems such as mangroves, fishing grounds and coral reefs. Coral bleaching and changes in ecosystem composition likely	Mangroves (and coral reefs of global importance)	Fisheries; tourism	Fisheries account for a sizable share of GDPs and sport fishing is important to tourist industries. Tourism accounts for high proportion of GDP and is highly dependent on the marine ecosystem. Coral bleaching is becoming more frequent and severe.
Flooding	Sea-level rise will result in flooding of coastal areas	Unique coastal wetlands and inter-tidal areas	Tourism; agriculture; forestry	Most tourism activities are located in the coastal zone. Significant capital investment assets and infrastructure could be affected. Loss of beaches and submergence will impact coastal breeding ground for species such as marine turtles.
Land degradation	Climatic extremities. Heavy rainfall increases tpotential for pest and diseases and causes excessive erosion. Drought affects productivity	Regional and globally significant species and ecosystems	Agriculture; tourism	Erosion will impact on coastal land developments, particularly tourism infrastructure. Agriculture sectors are limited in scope but land tourism is an important element of GDP.
Increased climate variability	Climate change may increase extreme events such tropical storms or droughts	Regional and globally significant species and ecosystems	Multi-sectoral	The cost of hurricanes and other natural disasters in the Caribbean have been estimated at hundreds of millions. These costs continue to increase and will affect tourism.

Adapted from DFID (2007) and Vegara (2005)

The biggest economic impact of climate change in the Caribbean is likely to be on tourism, the Caribbean's economic base, and the region's infrastructure (houses, hotels, industrial and commercial buildings, roads, etc.), which are predominantly situated along the coast. Approximately 70 percent of the Caribbean's human population lives along the coast along with most of the region's infrastructure, making them vulnerable to storms, sea-level rise and other coastal impacts of climate change (UNEP 2008). Already, the economic cost of natural disasters in the Caribbean has risen over the past 50 years, with the highest losses of $8 billion coming in 2004 (UNEP 2008). Tourism, which accounts for more than 15 percent of total employment in the Caribbean (UNEP 2008), will also be heavily impacted economically. More than 70 percent of the hotels in Barbados, for instance, are within 250 meters of the ocean at high tide (UNEP 2008), which along with their beaches makes them susceptible to storm surges, and sea-level rise. In addition, the loss of 80 percent of the corals in the Caribbean during the past two decades is also likely to reduce tourism in the region (UNEP 2008). The loss of tourist infrastructure will have profound effects for the Caribbean as a tourism destination.

The costs of inaction can be huge based on hurricane damages, tourism losses and infrastructure damages. For instance, in the case of Cuba (the country with the longest coastline in the Caribbean and with a land mass big enough to be hit by hurricanes travelling along several different storm paths), the cost of global climate inaction is put at nearly $5 billion/year by 2050,

growing to more than $10 billion/year by 2100 (Bueno *et al.* 2008), and amounts to 12.5 percent (at 2050) and 26.8 percent (at 2100) of Cuba's GDP. The costs of inaction could reach an astonishing 75 percent or more of GDP by 2100 in Dominica, Grenada, Haiti, St. Kitts and Nevis and Turks and Caicos, and a possible 22 percent of GDP for the Caribbean as a whole by 2100.

The economic and social consequences of climate change on the Caribbean islands, including loss of infrastructure, reduced tourism, beach erosion, increased flooding and storms, health risks, and agricultural damage, underscore the importance of protecting biodiversity and maintenance of ecosystem services in the region (UNEP 2008) as part of adaptation strategies that Caribbean countries need to develop in the face of climate change (Day 2009).

Climate Change Mitigation

Mitigation is an essential component of climate change strategies. There are mitigation strategies that the Caribbean can benefit from, in terms of reduced impacts from climate change, sustainable development, job provision, and environmental and biodiversity benefits.

Actions to reduce greenhouse gas emissions, such as an increased focus on renewable energy, may benefit the Caribbean through reduced air pollution, lower negative effects of fossil fuel pollution on the environment, and job creation as the Caribbean shifts away from its dependence on fossil fuels, most of which are imported at high cost in the Caribbean (UNEP 2008). Recognizing these potential benefits, some Caribbean countries are moving toward increased use of cleaner fuels. Another way in which the Caribbean may benefit economically from climate change mitigation is in the tourism sector. Some tourism sector representatives have discussed the idea of the Caribbean becoming a "zero-emission tourism destination," which would allow tourism operators to advertise the region to environmentally conscious travelers (Futuro Latinoamericano 2008).

A strategy aimed at encouraging climate change mitigation globally is the maintenance of stored carbon by reducing emissions from deforestation and degradation (REDD) (UNEP-WCMC 2009b). As current emissions due to deforestation are roughly 1.5 GtC per year, REDD is considered to have great potential in mitigating climate change (UNEP-WCMC 2009b). Though the mechanisms of REDD are still being worked out, it will likely be organized at the national level and measured relative to a baseline (UNEP-WCMC 2009b). While forests in the Caribbean are small, REDD may still have the potential to offer Caribbean nations an opportunity to participate in climate mitigation efforts while conserving habitats and the species that depend upon them. Other benefits include the maintenance of ecosystem services and the receipt of payments for protecting forests.

In general, climate change mitigation has not been a top priority in the Caribbean. As a region expected to be highly impacted by the effects of climate change, the Caribbean region may work to increase pressure on the global community to reduce emissions (Day 2009). Strengthening the Caribbean's voice in global climate change mitigation discussions is a key need as the region faces impacts from a problem it had little role in creating (Day 2009).

Major National and Regional Climate Change Policy Initiatives in Preparation or implementation

The IPCC considers SIDS to be among the most vulnerable to the projected impacts of climate change. Various international, regional and national initiatives have been developed recently to try to address the challenge. Regional programs that have sought to develop an informed and structured approach to climate change in the Caribbean Include the following:

- Caribbean Planning for Adaptation to Climate Change (CPACC)

- Adaptation to Climate Change in the Caribbean (ACCC)
- Mainstreaming Adaptation to Climate Change (MACC)
- Special Programme for Adaptation to Climate Change (SPACC)

The CPACC initiative (1997 to 2001, funded by GEF) was the first step in a comprehensive, long-term program of adaptation to global climate change. It served to build capacity for vulnerability assessment and monitoring, prepare national climate change adaptation policies and implement plans, and formulate technical assistance and investment projects.

The ACCC project (2001 to 2004, funded principally by the Canadian Climate Change Development Fund), which was built on the results and experience of the CPACC, focused on the development of risk management guidelines for climate change adaptation decision-making, further capacity building, and political endorsement for the establishment and of the business plan of the Caribbean Community Climate Change Centre (see Box 3). The ACCC also published a climate change handbook for Caribbean journalists, which provides an excellent overview of climate change and how it affects the region from a political, economic, ecosystem, climatic and country-specific (CARICOM countries) point of view. In addition, the ACCC developed guidelines for incorporating climate change adaptation in environmental impact assessments.

The MACC Project (2004-2008, funded by GEF) was mainly aimed at mainstreaming adaptation into sectoral strategies (public and private) and national development planning. The participating hotspot countries were: Antigua and Barbuda, the Bahamas, Barbados, Dominica, Grenada, Jamaica, St. Lucia, St.Kitts and Nevis, and St.Vincent. Apart from mainstreaming, outcomes of the project included the development of a strong public education and outreach program and a comprehensive communication strategy. Following on from these projects, a Regional Climate Change Strategic Plan has been drafted by CCCCC for endorsement by heads of government.

Together, the CPACC, ACCC and MACC projects generated significant outputs for the Caribbean region, particularly raising awareness of climate change among decisionmakers and have enabled more unification among regional parties and better articulation of regional positions for negotiations under the UNFCCC and the Kyoto Protocol. However, there appears to have been relatively little focus on terrestrial biodiversity and ecosystem services.

Box 3. The Caribbean Community Climate Change Centre (CCCCC)

In 2002, the Caribbean Heads of Government endorsed creation of a permanent facility in the region to address climate change. CCCCC, based in Belmopan, Belize, became functional in 2004. CCCCC coordinates much of the region's response to managing and adapting to climate change, and is responsible for advising regional governments on related policy matters. It is the official repository and clearing-house for regional climate change data, and coordinates sharing and accessing of information by a variety of stakeholders. CCCCC also plays an important role in quality assurance and ensures the standardization of procedures for the application of methodologies for vulnerability and risk assessments, national greenhouse gas accounting and climate modeling, and provides training in interpretation and use of the outputs. In addition, CCCCC is responsible for coordination and mobilization of funding and other resources for climate change activities in the region. It provides climate change-related policy advice and guidelines to the CARICOM member states through the CARICOM Secretariat, and in this role, is recognized by UNFCCC, UNEP and other international agencies as the focal point for climate change issues in the region. It has been recognized by the UN Institute for Training and Research as a Centre of Excellence.

A Special Programme for Adaptation to Climate Change (SPACC) project (2007-2011), supported by GEF, which was heavily influenced by the outcomes and experiences of the above projects, provides support to three CARICOM countries (Dominica, St. Lucia, St. Vincent and the Grenadines) for the assessment, design, implementation and monitoring of various measures to minimize the impacts of climate change on coastal and near-coastal biodiversity and land degradation in order to promote climate resilient development policies. Other important regional initiatives include the Climate Change and Biodiversity in the Insular Caribbean project being implemented by CANARI with funding from the MacArthur Foundation, which aims to develop a regional research agenda, assess the requirements to address identified knowledge gaps, and to consider how protected area management, biodiversity protection, and conservation policy might address climate change in the region. This has resulted in a series of important reports on climate change models and scenarios for the islands of the Caribbean, and climate change impacts on marine, coastal biodiversity and terrestrial biodiversity in the islands of the Caribbean (Cambers *et al.* 2008, Chen *et al*. 2008, Suárez *et al.* 2008, Day 2009).

Also at the regional level, UNDP established the Caribbean Risk Management Initiative in 2004 as an umbrella program designed to build capacity across the Caribbean region for the management of climate-related risk, and the World Bank has also proposed an Action Plan for the World Bank in Latin America (Vergara 2004), which includes activities to improve the knowledge base for key ecosystems. IUCN's Programme of Work for 2009-2012 for the Caribbean region under its IUCN Caribbean Initiative includes a thematic priority area addressesing climate change, with a focus on integrating biodiversity considerations and opportunities into climate change policy and practice. Other projects include the joint University of Oxford-CCCCC CaribSAVE initiative that aims to tackle the challenges of climate change and its effect on tourism in the Caribbean region. Part of the seed funding from the U.K. Department for International Development will be spent on six-month pilot studies on Eleuthera in the Bahamas and Ocho Rios in Jamaica.

However, to date only a few species-specific adaptation plans have been developed in the region, one example being for marine turtles (Hawkes 2008). In terms of training and research, the University of the West Indies is an important regional center, and has recently created a Master of Science program in climate change at its Centre for Resource Management and Environmental Studies (CERMES), at the Cave Hill Campus in Barbados.

Projects at National Level

At the national level, initiatives have been more limited so far. Cuba is participating as a pilot country in the Capacity Building for Stage II Adaptation to Climate Change in Central America, Mexico, and Cuba project (UNEP 2008), which aims to demonstrate how adaptation policy can be integrated into national sustainable development efforts in at least four human systems: water resources, agriculture, human health, and coastal zones. There is also a proposal to construct a Climate Change facility on Montserrat, on the summit of Silver Hills in the north of the island, which would serve as a center for applied research on key socioeconomic issues that may be impacted by climate change in the Eastern Caribbean region. In Jamaica, a national public education campaign and communication strategy on climate and its impacts is being conducted by the National Environmental Education Committee and Panos Caribbean, involving popular Jamaican entertainers as climate champions.

Implementation of adaptation measures at the local level and community involvement in climate change adaptation projects is still in its initial stages in the Caribbean, and there have been few projects. With regard to biodiversity and ecosystem services these include a limited number of habitat restoration projects, including mangrove restoration projects. Restoration and management

of mangroves are being promoted as key tools to build resilience to climate change in tropical coastal states. See McLeod and Salm (2006), Managing Mangroves for Resilience to Climate Change. In addition, Cuba has developed beach restoration technology to restore ecological and functional value of the coasts. Although reforestation projects in the region have been promoted as helping to decrease vulnerability and increase resilience to climate change and have the potential to qualify for future REDD funding, most restoration projects to date have focused on the marine environment, particularly coral reef restoration.

All independent Caribbean islands states have ratified the UNFCCC and the Kyoto Protocol and are listed as non-Annex I Parties, and all have produced their first National Communication, which identifies critical vulnerabilities to climate change and recommended adaptation options to address them, but none have yet finalized their second National Communication.

Under the ACCC Project, nine countries in the hotspot (Antigua and Barbuda, Barbados, Bahamas, Dominica, Grenada, Jamaica, St.Kitts and Nevis, St.Lucia, St.Vincent and the Grenadines) prepared national climate change adaptation policies. In Dominica, St.Vincent and the Grenadines and St.Lucia, the policies were tabled in parliament and approved. Haiti, as a Least Developed Country, has produced a National Adaptation Plan of Action that has 14 priority projects, six of which are concerned with watershed restoration and/or reforestation, and two with improving natural resource management or sites (in Northeast Province and Artibonite Province). However, most policies do not give adequate attention to natural resources management or conservation of biodiversity and ecosystem services as an integral tool for adaptation.

Adaptation to climate change in the overseas countries and territories had received less attention and funding than in the independent states until recently. The European Union hosted a major conference in 2008 to discuss climate change and biodiversity loss in its Overseas Entities (www.reunion2008.eu) and produced a background paper "Climate Change and Biodiversity in the European Union Overseas Entities," which contains a review of threats to their biodiversity from climate change in the Caribbean region EU entities. In March 2007, the CCCCC signed a Memorandum of Understanding with the UK government (through DFID) for the Enhancing Capacity for Adaptation to Climate Change project for activities in the Caribbean U.K. Overseas Territories (Anguilla, British Virgin Islands, Cayman Islands, Montserrat, Turks and Caicos). The aims include enhancing national capacities to undertake vulnerability and risk assessments in key environmental and socioeconomic sectors, among other things. The project seeks to link the five territories with the CCCCC regional programs, broadly follows the MACC project, and draws on the SPACC project. However, the funding available (£300,000) is not substantial.

Integration of Biodiversity into Policies

A number of biodiversity-related conventions to which most of the Caribbean states are signatories, including the Ramsar Convention and the CBD, have adopted decisions concerning biodiversity and climate change. Chief amongst these is the integration of climate change into most of the programs of work of the CBD and particular vulnerability of islands to the impacts of climate change is acknowledged in its program of work on island biodiversity that includes a number of priority actions, such as:

- Research and implement adaptation and mitigation measures in land-use and coastal zone planning and strategies to strengthen local-level biodiversity resilience to climate change.
- Create, where feasible, viable national systems of protected areas which are resilient to climate change.
- Consider afforestation and reforestation projects that enhance island biodiversity, noting that it may be possible for these projects to be eligible to generate certified emission reduction units under the Kyoto Protocol Clean Development Mechanism.

- Develop models to understand the vulnerability of island biodiversity to climate change.

These aim to strengthen local-level resilience to climate change, but also means that pursuing national climate change adaptation strategies provides an opportunity for Caribbean islands to meet their obligations under the CBD. However, only three countries in the region (Barbados, Cuba and Dominica) have national plans with specific objectives or actions to link biodiversity and climate change. A capacity-development workshop to enhance the integration of climate-change considerations in national biodiversity strategies and action plans and implementation of the CBD was convened in Trinidad and Tobago in 2008. Two important documents dealing with biodiversity and climate change in the Caribbean and their mainstreaming into government policy have been produced in relation to this workshop (UNEP/CBD 2008, UNEP/CBD 2009).

As mentioned previously, there have been calls to improve existing measures to protect biodiversity as a key critical aspect of adaptation policy and the need for the region to re-examine its conservation strategies and adopt a more pragmatic approach (Day 2009). The planning and effective management of protected areas need to be made more "climate proof" (most current management plans do not take climate change into account). However, in most cases, addressing the region's existing environmental problems through active management will not only improve the resilience of the ecosystems and well-being of communities today, but will also place them in a better position to adapt to climate change. Adaptation to climate change can therefore be viewed as a "no regrets" strategy for sustainable development (IPCC 2007).

Although many of the current national adaptation strategies and plans, such as those for St. Lucia, do promote conservation of biodiversity and ecosystem services as a key tool to reduce vulnerability and increase resilience to climate change, these are not yet well integrated into broader national planning and development programs and practical implementation projects are still scarce. For instance, Jamaica has a variety of policies and plans that are relevant to adaptation and mitigation (including the Forest Policy and the National Forest Management and Conservation Plan; the National Land Policy; the Watersheds Policy; the National Energy Sector Policy; National Biodiversity Strategy and Action Plan; and the National Hazard Mitigation Policy) but there is no overarching framework for addressing climate change, and adaptation measures have not been integrated into these plans, although a Task Force on climate change and hazard reduction has been established.

Needs and Opportunities for Strengthening Integration of Biodiversity into Climate Change Adaptation/Mitigation Planning

Despite the large number of past and current climate-related projects and programs in the region, there remain a number of major challenges and needs, especially in regard to ensuring more effective integration of biodiversity into climate change adaptation policy and planning.

Lack of capacity: Like many SIDS, the Caribbean islands have a limited pool of professionals with expertise in multiple disciplies (such as meteorology and the biosciences), and few with the necessary skills to effectively assess and/or examine climate change issues.

Lack of climate change considerations in management plans: As previously mentioned, networks of protected areas are seen as critically important to the preservation of biodiversity under climate change and key elements of national adaptation plans, but their management is often inadequate or non-existent in the Caribbean and current management plans for protected areas do not take climate change into account (Suárez *et al.* 2008).

Lack of information: There appears to be a lack of research focusing on how climate change will affect terrestrial biodiversity (Day 2009). Research in this area in the Caribbean is considered to be in its infancy, and existing data has not been adequately transferred to maps or geo-referenced databases, or used in climate-related modeling. Information is particularing absent for the potential economic impact of climate changel linkages between ecosystem services, human well-being and climate change; resilience and restoration; agro-biodiversity; protected areas; vulnerability assessments; and communication and outreach (Day 2009).

Limited civil society engagement: At present there is mimimal participation by civil society in the adaptation policy debate. Consequently, national and regional climate plans may not have the support of individuals, communities, or stakeholder groups, and therefore may have limited success (Walling undated).

Limited private sector engagement: The business sector has had a relatively minor role in promoting or implementing adaptation programs in the region. However, awareness of the impact of climate change on specific economic sectors is increasing and there have been some interesting initiatives, including the promotion and uptake of the Green Globe Certification (e.g. by some hotels in Jamaica), which encourages resource conservation within the hotel industry. Also, the insurance sector has become more engaged with climate change in the Caribbean, and a briefing document on the implications of climate change, adaptation and risk management has recently been produced by the Caribbean Catastrophe Risk Insurance Facility (CCRIF 2009).

In sum, although there are some gaps in how climate change is being addressed in the Caribbean Islands hotspot, there are many pertinent actions being undertaken by a wide variety of national, regional and international organizations and entities. Climate change is well-acknowledged by national governments, and the issue is receiving funds on many levels.

ASSESSMENT OF CURRENT INVESTMENT

This assessment describes the most important recent investments in biodiversity conservation in the insular Caribbean, gleaned from organization Web sites, personal contacts with these organizations, and from the recipients of these funds. Projects are described that have direct benefits for biodiversity conservation, including those related to climate change and adaptation. Projects active in 2009 or planned for the near future are included. A listing of individual projects is provided in Appendix 3, and a summary of the key findings is in Box 4 below.

The unique history of the insular Caribbean has given rise to at least three very different forms of government that have helped to determine the kinds of conservation investments made in each type. The developing independent nations (the Dominican Republic is the largest) have attracted by far the most “external” funding from multilateral (especially GEF), bilateral and private sources. Almost all multilateral aid is provided to and through national government agencies, with the exception of the GEF Small Grants Program. The overseas territories of the United States and several European countries (France, the Netherlands and UK) have received funding from programs in their home countries, although they have not always been able to compete well for those funds. Finally, the centrally planned economy of Cuba, the largest Caribbean island, while having significant multilateral investments has been able to attract few other donors.

Major Sources of Investment

National Government Expenditure

Expenditures on biodiversity conservation by the more than 30 governmental entities in the Caribbean are not readily available, a problem compounded by divided and sometimes overlapping jurisdictions for natural resources management. To illustrate the approximate scale of these expenditures, the forestry department of a larger island reports a budget for 2008 of approximately $293,000, while the environment agency of that island reports a budget of approximately $2.86 million.

Bilateral and Multilateral Donors

GEF is providing the most significant recent conservation funding in the region, and much of the bilateral and national funding for the region is directed to co-finance these projects. About $39 million in GEF funds (plus more than that in co-finance) are committed over the next several years to biodiversity conservation (to protected areas, for example) and climate change adaptation, while additional funds will provide indirect benefits through sustainable development and watershed protection projects. These investments are concentrated mainly, but not exclusively in the larger independent countries of Cuba, the Dominican Republic, Haiti and Jamaica.

Three of the largest Caribbean countries (Dominican Republic, Haiti and Jamaica) are each about to begin large-scale projects to strengthen their existing protected areas systems, funded by the GEF through UNDP. These Full-Size Projects will provide approximately $3 million to each of the responsible ministries over five to six years, which will be matched by $6 million to $8 million in co-financing from both national and international sources. These projects will seek to 1) create sustainable financing mechanisms, 2) establish co-management capabilities, 3) improve management operations, and 4) integrate the protected area system in legislative and policy frameworks (in Jamaica). A similar regional project for the OECS countries (Lesser Antilles) is concluding in 2009; its aim was to contribute to the conservation of biodiversity of global importance by removing barriers to the effective management of protected areas and by increasing the involvement of civil society and the private sector in the planning, management and sustainable use of these areas. GEF provides $3.7 million for this *OECS Protected Areas and Associated Livelihoods Project*, and it is co-financed with $2 million from the Organization of American States and the Fonds Francais de l'Environnement Mondial. Continued funding is sought to continue the advances made in this project.

Additional multilateral funding is currently being exercised in the developing independent nations through a number of venues. A GEF/UNEP multi-island project, *Mitigating the Threats of Invasive Alien Species in the Insular Caribbean*, is providing $2.6 million plus co-financing in a broad partnership that is focusing on the development of national strategies, establishment of a strategy and Caribbean-wide cooperation, improvement of information management, prevention of introductions of invasive alien species and early detection. Participating countries include the Bahamas, Cuba (initial phase only), the Dominican Republic, Jamaica and St Lucia.

UNEP's Caribbean Environment Programme (one of its Regional Seas Programs) aims to promote regional co-operation for the protection and development of the marine environment of the Wider Caribbean Region. The program has several ongoing projects focusing on wastewater, pollution and a special program on communication, education, training and awareness, but none directly addressing biodiversity conservation.

Bilateral aid from developed countries represents another important source of funding for the developing independent countries of the Caribbean, some of which is provided as co-financing for the GEF projects described above. Each national donor agency seems to specialize in a given portfolio of recipient countries, often based upon historical or commonwealth affiliations. In a complex and overlapping array of aid, the EU and individual member countries all have international development programs. Under the EU's European Development Fund, several programs relate directly to biodiversity conservation, including the Caribbean Regional Environment Programme and the Cross-border Environmental Programme (Haiti and the Dominican Republic). The French Government, along with the Italian Government, has funded the opening of a Caribbean Initiative by IUCN. The Spanish Agency for International Cooperation for Development invests primarily in Cuba, the Dominican Republic and Haiti; it has supported sustainable development activities in the Jaragua-Bahoruco-Enriquillo Biosphere Reserve. Germany's GTZ targets the Dominican Republic via a capacity building project on Forest Stewardship Council (FSC) certification, which focuses on advice and training to smallholders for the development of sustainable management plans, upgrading forestry practices and securing usage rights. The U.K.'s Department for International Development has a wider portfolio in the Commonwealth Caribbean (e.g. Barbados, Bahamas, others), and Italy has invested in Cuba and Hispaniola.

The Japan International Cooperation Agency has supported the development of marine fisheries and seafood processing facilities in a number of countries. The U.S. Agency for International Development supports sustainable development activities in Jamaica and the Dominican Republic, and in Haiti there is a special focus on reforestation to reduce vulnerability to erosion and natural disasters. The Tropical Forest Conservation Act (TFCA), also managed by USAID, is an innovative debt-for-nature swap mechanism that is providing about $16 million over 20 years (beginning 2004) to Jamaica. The funding is distributed in a grants program run by the Environment Foundation of Jamaica, and includes funding from The Nature Conservancy. The Canadian International Development Agency is active throughout the Caribbean, with a particular emphasis on forest management and conservation.

GEF recently approved funding for full-sized biodiversity conservation projects, as well as small grants to community–level projects, in Cuba. A $5.7 million project is underway to improve management of protected areas in the coastal zone of the southern archipelagos. While most of the co-finance is provided by the host government, World Wildlife Fund–Canada provides $500,000. In the northern archipelagos, a $4 million project would address conservation by working closely with three productive sectors: tourism, fisheries and sugar.

The U.S. and EU islands have generally benefitted from conservation programs originating in their home countries. In Puerto Rico and the U.S. Virgin Islands, for example, U.S. government agencies manage thousands of hectares of national forests, parks and wildlife refuges, protecting some of the most significant biodiversity in the Caribbean. National government programs like Wildlife and Sport Fish Restoration and the Endangered Species Program distribute several million dollars annually to territorial conservation. Because of the Caribbean's importance to birds that migrate through the region or remain for the nonbreeding season, the U.S. Fish and Wildlife Service has supported conservation projects there through the Neotropical Migratory Bird Conservation Act grants program. Several hundred thousand dollars annually go toward protecting and restoring habitats, providing environmental education and outreach, and compiling important data in Puerto Rico and throughout the region (with the exception of Cuba). The British Islands have benefitted from the Overseas Territories Environment Program and the Darwin Initiative. The French Islands are Départements of France, fully integrated into the national

agencies. Conservation in the Dutch Islands has been consolidated with the creation of the Dutch Caribbean Nature Alliance.

International Organizations and Foundations

With just a small number of notable exceptions, investments from international organizations and foundations in the developing independent countries have been relatively limited in the Caribbean. BirdLife International is focusing on conservation action at Important Bird Areas, working with Local Conservation Groups through its partners and wider network of collaborating NGOs. BirdLife is currently investing about $1.3 million on site-based actions in seven countries with the support of Aage V. Jensen Charity Foundation, Denmark; British Birdwatching Fair; Neotropical Migratory Bird Act- U.S. Fish and Wildlife Service; Canadian International Development Agency; and individual donors. The Nature Conservancy pursues many conservation activities from its Caribbean offices. In the Bahamas, for example, The Nature Conservancy and the Bahamas National Trust have trained and organized teams to address invasive species and fire control issues in protected areas. Rare supports Pride campaigns in the Bahamas, St. Lucia, and Belize to build local support for conserving the spiny lobster, wetland bird habitat and rare iguana species. Also present are Durrell Wildlife Conservation Trust (U.K., with an office in St. Lucia; habitat restoration, invasive species control, research and monitoring as well as some ex situ species conservation, focused on St. Lucia, Antigua, Montserrat, Cayman Islands and Dominican Republic) and Fauna and Flora International (U.K.; building capacity in the management of forests and protected areas, invasive species control, and recovery of threatened species, currently focused on St. Lucia, Anguilla and Antigua and Barbuda). FFI and Island Conservation have projects underway to eradicate invasive species from smaller islands.

In regard to private foundations, the MacArthur Foundation is currently supporting more than 20 projects in the Caribbean that target conservation of important biodiversity areas as well as climate change and good governance. While several of these are about to be completed (including two major assessments related to climate change), the remaining 14 projects total approximately $4.3 million. Several of the MacArthur Foundation projects are focused on key biodiversity areas, such as Cockpit Country in Jamaica and Jaragua-Bahoruco-Enriquecillo Biosphere Reserve in the Dominican Republic, as well as natural resources and protected area management in Cuba. However, investment in biodiversity conservation by other private foundations is uncommon, and those foundations that are funding environment projects are not focused on the conservation outcomes identified in the ecosystem profile. The Christopher Reynolds Foundation has funded a small number of grants of less than $50,000 to U.S.-based organizations dedicated to building conservation capacity in Cuba. Both the Sandler and Kaplan foundations have also provided modest grants for marine conservation in the region.

Box 4. Current Investments in Biodiversity Conservation in the Insular Caribbean

Approximately $54 million is currently invested in biodiversity conservation and climate change adaptation. Of that:

- $39 million (72 percent) is from multilateral sources
- $10 million (18 percent) is from bilateral sources
- $5 million (10 percent) is from private sources

- $34 million (63 percent) is going to CEPF eligible countries
- $20 million (37 percent) is going to non-CEPF countries

- $45 million (84 percent) is going to governments
- $5 million (10 percent) is going to international organizations

- $2 million (3 percent) is going to Caribbean organizations
- $2 million (3 percent) is to be determined

- $7 million (12 percent) is going to key biodiversity areas

Investments are concentrated in the larger independent countries: Cuba, Dominican Republic, Haiti and Jamaica.

Note: Figures do not include sustainable development or marine projects.

Summarized Investment for the Region

Overview of Funding for Various Countries in the Region

GEF is the most important external funder, with tens of millions of dollars in current conservation related investments in the Insular Caribbean. This "centerpiece" of investment has attracted tens of millions more as co-finance both directly to these projects and through compatible projects, mainly from bilateral donors, but also from a few private organizations and from national governments. All of the independent countries have benefitted from GEF funding, although the larger among them (Cuba, Dominican Republic and Haiti) have garnered the most. Bilateral funding from developed countries is the next most important, with several million in current investment beyond the co-finance referenced above. Bilateral funding has tended to follow donor country preferences, sometimes based upon commonwealth or historical connections.

The Caribbean has attracted only a few private organizations and foundations. The MacArthur Foundation has made the Caribbean one of its regional foci in recent years. Unlike in some other hotspots of biological diversity, where conservation interests have successfully worked with the private sector (for example, with plantation agriculture or cattle ranching), there has been little such cooperation in the Caribbean from large-scale tourism or from mining.

Key Strategic Funding Initiatives

The Government of the Netherlands has begun fundraising to capitalize a protected areas trust fund for the Dutch Islands (Aruba, Bonaire, Curaçao and St. Maarten). This endowment fund would be managed by the Dutch Caribbean Nature Alliance (DCNA), and would provide a portion of the annual funding for NGOs to manage these areas. The Dutch islands and DCNA have also secured longer-term commitments from Dutch sources like the Dutch Postcode Lottery through Vogelbescherming Nederland (BirdLife in the Netherlands).

A Payment for environmental services (PES) scheme has recently been created in the Dominican Republic. A fund (Fondo de Ecodesarrollo de la Cuenca) has been created to finance land conservation activities (fire control, reforestation, erosion control, sustainable coffee) as part of a larger UNDP project *Demonstrating Sustainable Land Management in the Upper Watershed of the Sabana Yegua Dam*, with partial funding from the Japan International Cooperation Agency. Such schemes have generally not been implemented elsewhere in the Caribbean, although the larger GEF projects on sustainable financing for protected areas promote these schemes (these projects are just approved). The Windsor Research Centre is developing similar economic incentives in two Jamaican watersheds with assistance from the MacArthur Foundation.

Thematic Distribution of Investment

With GEF and some bilateral co-finance going to national government ministries, the majority of funding for biodiversity conservation in the Insular Caribbean is therefore to public agencies. The

dominant theme for this funding is protected areas management ($18 million in GEF funds alone); indeed, a common element for these projects is the establishment of sustainable financing mechanisms for their management. Some of the Caribbean NGOs have co-management responsibilities (for example, Bahamas National Trust) or are otherwise concentrated on protected areas and thus have an important partnership role in ensuring success.

Mainstreaming of environment into the economic sector is a high priority for many donors, and this objective is evident in the numerous projects focusing on agriculture, tourism and infrastructure. For instance, the need to consider environment in other sectors is heavily promoted in European Community development policy and programs in the region. In addition, a number of environmental projects have a key component on mainstreaming conservation into other sectors, such as the $4.3 million UNDP-GEF project *Mainstreaming and Sustaining Biodiversity Conservation in Three Productive Sectors of the Sabana Camaguey Ecosystem* in Cuba.

GEF and some bilateral funders have targeted the problem of land degradation, especially in Haiti and with mixed success. Reforestation, soil conservation and watershed protection activities have indirect benefits for biodiversity. GEF and other funding for climate change adaptation have taken off in recent years, and these also include addressing land degradation, as well as protection of mangroves and other beneficial activities.

Community-based organizations have benefitted from funding for conservation-related activities in the buffer zones of protected areas. The GEF Small Grants program and other funders have provided funding for compatible agriculture, conservation forestry and ecotourism development in such areas, however at a considerably smaller scale. There is potential for significant conservation benefit through an organized approach to these areas, in some cases linked into biological corridors.

Investment in Key Biodiversity Areas

Some of the region's key biodiversity areas are located within existing protected areas systems and may therefore receive some level of government investment. Key biodiversity areas within protected areas would also benefit from national-level GEF projects whose objectives include improved management and sustainable financing (for example the project *Strengthening Operational and Financial Sustainability of the National Protected Area System* in Jamaica). However, few of these protected areas are adequately managed, and some are not managed at all. Thus the needs are significant, and the amount of funding likely to filter down to individual protected areas and key biodiversity areas is relatively small. While protected areas projects provide for agencies to forge and participate in co-management schemes, the funding does not support civil society and hence a critical component for sustainability.

Two of Haiti's key biodiversity areas—Massif de la Hotte and Massif de la Selle—are both among the most important key biodiversity areas in the world and have ongoing and proposed multilateral and bilateral investments to address land degradation and watershed conservation that, if successfully implemented, would have significant benefits for these sites. These key biodiversity areas, however, and their conservation challenges, are large and there is a need to focus investment directly on biodiversity within the larger conservation and sustainable development context. There is clearly a role for the growing network of Haitian conservation NGOs to more directly address biodiversity and complement these larger efforts.

Only about 12 percent of the external investments described in this profile (approximately $7 million) is directed to NGOs, and only a smaller portion of this investment (about $2 million) is allocated to organizations based in the Caribbean Hotspot. While the Canadian International

Development Agency, for example, has been exceedingly generous in support of Caribbean conservation, none of the funds go directly to Caribbean NGOs. While Caribbean NGOs will participate in these projects, it is beyond the scope of this profile to determine exactly how much funding they will receive. Caribbean NGOs receive most of their support via small grants from national sources, with a much smaller portion coming from international donors.

CEPF NICHE FOR INVESTMENT

CEPF's niche for investment in the Caribbean Islands Hotspot was formulated through an inclusive, participatory process that engaged civil society, donor and governmental stakeholders throughout the region, and is based on an analysis of information gathered during the profile preparation process. While information from all countries in the hotspot has been compiled, this section focuses on determining where CEPF can add the greatest value in the following countries currently eligible to receive CEPF funds as both signatories to the Convention on Biological Diversity and World Bank client countries: Antigua and Barbuda, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines. In addition, the Bahamas and Barbados are included as priorities for CEPF investment because of their eligibility to receive GEF funds specifically.

Analysis and consultations conducted during the profile process demonstrate that the Caribbean Islands Hotspot is at a crossroad in its development trajectory. With few exceptions, most countries in the hotspot have built economies classified as middle income that are heavily reliant on ecosystem services, particularly for tourism, agriculture and fisheries. The region's ecosystems provide vital freshwater resources, help to mitigate the impacts of hurricanes, regulate local climate and rainfall, prevent soil erosion, produce hydroelectricity and yield locally consumed non-timber forest products. Additionally, the hotspot spans more than 4 million km^2 of ocean and has many thousands of kilometers of productive coastal and near-shore habitats. The coastal and marine environments are essential for the tourism and fisheries sectors. Both terrestrial and marine ecosystems host unique assemblages of flora and fauna of high global importance.

However, this profile also reveals that these island ecosystems are particularly fragile, finite and under significant pressure. Economic policies have failed to fully consider the importance of protecting and maintaining the provision of ecosystem services. While significant strides have been made in enacting environmental laws and establishing protected area systems, their effective implementation has fallen far short. As a result, environmental degradation is taking a toll in several respects. Agriculture and fisheries are declining, in part due to environmental degradation. The provision of freshwater to meet growing populations is a serious concern. Furthermore, the region has among the highest numbers of globally threatened species in the world. Its key biodiversity areas top the world's list of AZE sites, which the international conservation community has agreed are the most urgent site-level conservation priorities globally. The wholesale degradation of Haiti serves notice to the rest of the Caribbean community of the risk of environmental mismanagement, as the impacts have resulted in the country topping the hemisphere's lists for poverty, human deprivation and disaster risk.

The advent of climate change and its disproportionate impacts on the islands of the Caribbean, combined with continued population growth, emphasizes the importance of maintaining what intact ecosystems remain, of strengthening their resilience and of restoring degraded ecosystems. This imperative is not only critical for maintaining biodiversity but also has clear implications for the future welfare of the people of the Caribbean.

Several opportunities exist to leverage support for the kind of approaches that will help lay a foundation for a more sustainable economic base and future. Responsibility for natural resource management in the Caribbean lies primarily with national governments, which, together with international donors, are investing significant resources in natural resources management and conservation. However, the complexity of the challenge requires that civil society in all its various forms, from national environmental groups to small community-based organizations, must also fulfill a vital role as key advocates of and stewards for biodiversity and the benefits it provides for people. Civil society groups need to effectively participate in environmental management if current donor and government efforts are to be successful, and if the hotspot is to set a development path that fosters environmental sustainability. While the need for a robust civil society sector is high, the profile finds that the sector lacks the full set of capacities to fulfill its role to the extent required, for example, with respect to possessing strong technical expertise on the key issues and to forging successful working relationships and strategic alliances within the environmental community and with other sectors and stakeholders.

Given this backdrop, the CEPF niche will be to support civil society groups so that they can serve as effective advocates, facilitators and leaders for conservation and sustainable development of their islands. The need for such leadership is urgent. Civil society groups are in a unique position in the Caribbean to fulfill this role, as they have significant knowledge of and experience with the biodiversity held in individual key biodiversity areas and conservation corridors, and they can bridge local development aspirations with longer term conservation goals. In several islands, civil society groups have been the key advocates for development approaches that are environmentally sustainable, particularly for mining and tourism development. Their biological expertise, field experience and leadership role for environmental sustainability puts them in a unique position to help preserve their environment. As a result, CEPF will empower and enable civil society groups to engage in strategic conservation efforts, as well as participate in and influence broader development planning and policy agendas.

The profile identifies strategic points of entry where civil society can play a critical role through four closely linked strategic directions detailed below:

1. Improve protection and management of 45 priority key biodiversity areas.
2. Integrate biodiversity conservation into landscape and development planning and implementation in six conservation corridors.
3. Support Caribbean civil society to achieve biodiversity conservation by building local and regional institutional capacity and by fostering stakeholder collaboration.
4. Provide strategic leadership and effective coordination of CEPF investment through a regional implementation team.

This portfolio also includes special emergency support to Haitian civil society to mitigate the impacts of the 2010 earthquake. This support was approved separately by the Donor Council in March 2010 and has been incorporated as a fifth strategic direction, Provide emergency support to Haitian civil society to mitigate the impacts of the 2010 earthquake.

Guiding principles that underpin this strategy rest on the need for CEPF to focus on those outcomes that can have the greatest impact on conservation in the insular Caribbean. CEPF aims to leave a legacy whereby the hotspot's most important biological sites and corridors have been strengthened so that they continue to sustain rich and diverse habitats, provide vital ecosystem services for the people of the Caribbean, and are better prepared to withstand looming threats from global climate change.

To ensure the greatest incremental contribution to the conservation of the global biodiversity values of the Caribbean Islands Hotspot, CEPF investment will focus on 45 of the highest-priority key biodiversity areas, many of which are embraced by six conservation corridors. Many of these key biodiversity areas are coastal and dependent on the health and resilience of the adjacent marine environment and as such, CEPF will adopt the 12-nautical-mile territorial sea definition established by the U.N. Convention on the Law of the Sea as the outermost limit for CEPF attention and investment. This means that conservation actions pertaining to a coastal key biodiversity area can include, as necessary, the belt of ocean measured seaward from the coastal nation and subject to its sovereignty. It should be noted that while the territorial sea definition is based on political, rather than biological, criteria, it also aims to assist sovereign nations to protect their marine resources.

All of the 45 priority key biodiversity areas contain globally important biodiversity, and all are important for the provision or regulation of ecosystem services to local human populations. Yet these same areas face a range of threats, including incompatible development and agricultural initiatives, invasive species and unsustainable use. While all are urgent priorities for conservation action and need investment and management attention, they also have a high potential for conservation success and present excellent opportunities for CEPF investment.

CEPF INVESTMENT STRATEGY AND PROGRAM FOCUS

As a first step in focusing CEPF investment in the Caribbean, a prioritization of site outcomes was undertaken. Although all site outcomes are important for global biodiversity conservation, the full number of key biodiversity areas is far too many for CEPF to effectively support. It is hoped that this profile will be used by other donors and organizations to further target their funding and efforts and thus complement and expand the CEPF investment.

In the first instance, two criteria were used to assess the biological priority of each key biodiversity area: irreplaceability and species-based vulnerability. Irreplaceability is determined by the percentage of the global population of a species that is held in a site. Species-based vulnerability is based on the IUCN Red List threat status of a species. A focus on irreplaceability allows prioritization of sites that hold species likely to become extinct if those sites are lost. A focus on species-based vulnerability enables support for those species at greatest risk of extinction. The scores from these two criteria were then combined to create an overall ranking of priority for these key biodiversity areas, as detailed in Appendix 5.

Within each resulting priority level, key biodiversity areas with more globally threatened species are prioritized over those with fewer globally threatened species. Prioritization of the hotspot's key biodiversity areas resulted in 46 "Priority 1" sites (the highest priority), 118 Priority 2 sites, 59 Priority 3 sites and 39 Priority 4 sites. The key biodiversity areas defined for Cuba were not included in the prioritization as the data includes only IBAs and thus birds at this time.

This analysis was further refined by examination of additional factors such as availability of funding, level of threat and level of management. Some sites represent well-funded or well-managed protected areas, while others are not imminently threatened. In order to identify, as objectively as possible, the highest-priority key biodiversity area for CEPF investment, an additional two-tier process was undertaken. Firstly, at the national workshops in Dominican Republic, Haiti and Jamaica (which account for 50 percent of the eligible Priority 1 and 35 percent of the Priority 2 key biodiversity areas), participants selected key biodiversity areas from among these classifications as investment priorities based on collective knowledge of conservation need, conditions for successful conservation action and multiplier effects (from

adjacent sites or from previous actions). For the highest-priority key biodiversity areas, these variables were then scored (on a scale from 1-4) along with other important thematic issues such as ecosystem services provision and climate change adaptation opportunities. A table of these thematic scores for the highest-priority key biodiversity areas is presented in Appendix 4. For the key biodiversity areas in the remaining countries, the priorities for investment were selected based on their biological priority score, consultation with national experts and analysis of relevant published literature.

As a result of this multi-stage prioritization process, 45 key biodiversity areas have been selected for CEPF investment, with 17 of these sites identified as being the highest priority. All 45 sites are listed in tables 14 and 15 (with details in Appendix 5) along with their protection status (although it must be noted that formal designation does not imply actual protection or management). See Appendices 6 and 7 for details and justification for the 17 highest-priority site outcomes.

Fourteen of the key biodiversity areas contain some of the Caribbean's most important coastal and near-shore habitat. For example, more than 100 crawls per year have been registered for globally threatened sea turtles along the beaches of the Scotland District in the Barbados and the Offshore Islands of Antigua and Barbuda, making these beaches among the highest priorities for sea turtle conservation in the hotspot. The Parque Nacional Jaragua in the Dominican Republic is one of the Caribbean's largest protected areas and contains extensive and exceptional coastal and marine habitat. The Portland Sound and Bight Key Biodiversity Area in southern Jamaica provides essential disaster mitigation services, such as protection from storm surges, and is also economically important for its fisheries. As noted earlier, CEPF investment may include consideration of the marine environment as it relates to the conservation of these key biodiversity areas, and therefore interventions may take place in the coastal, near-shore and marine habitats within the 12-nautical-mile territorial sea measured seaward from the actual key biodiversity area.

Table 14. Highest-Priority Key Biodiversity Areas for CEPF Investment in the Caribbean

Key Biodiversity Area	Country	Status	Area (km^2)	Current Funding
Bahoruco Oriental	Dominican Republic	Wildlife Refuge	61	
Jaragua National Park	Dominican Republic	National Park	1,694	GEF/UNEP funds for mitigating the threat of invasive species; MacArthur funds for the Jaragua-Bahoruco-Enriquillo Biosphere Reserve; MacArthur funds for plant conservation and sustainable management in Jaragua-Bahoruco-Enriquillo Biosphere Reserve; Aage V. Jensen Foundation funds for saving the treasures of the Caribbean
Loma La Humeadora	Dominican Republic	National Park	315	
Sierra de Bahoruco	Dominican Republic	National Park / Unprotected	1,152	Darwin Initiative funds for conservation of endemic mammals; MacArthur funds for the Jaragua-Bahoruco-Enriquillo Biosphere Reserve; MacArthur funds for plant conservation and sustainable management in Jaragua-

Key Biodiversity Area	Country	Status	Area (km^2)	Current Funding
				Bahoruco-Enriquillo Biosphere Reserve; Aage V. Jensen Foundation funds for saving the treasures of the Caribbean
Valle Nuevo	Dominican Republic	National Park	933	
Citadelle	Haiti	National Park	14	
Massif de la Hotte	Haiti	National Park / Unprotected	1,287	Darwin Initiative funds for conservation of endemic mammals; USFWS funds for saving critical sites for neotropical migratory birds; Aage V. Jensen Foundation funds for saving the treasures of the Caribbean
Massif de la Selle	Haiti	National Park / Unprotected	1,669	
Morne Bailly	Haiti	Unprotected	21	
Plaisance	Haiti	Unprotected	93	
Catadupa	Jamaica	Forest Reserve / Unprotected	158	
Cockpit Country	Jamaica	Forest Reserve / Unprotected	749	MacArthur Foundation funds for: a plant conservation strategy; biodiversity conservation; strengthening community involvement in conservation; Aage V. Jensen Foundation funds for saving the treasures of the Caribbean
Dolphin Head	Jamaica	Forest Reserve / Unprotected	168	
Hellshire Hills	Jamaica	Protected Area	147	
Litchfield Mountain-Matheson's Run	Jamaica	Forest Reserve / Unprotected	158	
Peckham Woods	Jamaica	Unprotected	75	
Portland Ridge and Bight	Jamaica	Protected Area	430	

Table 15. Other Priority Key Biodiversity Areas for CEPF Investment in the Caribbean

Key Biodiversity Area	Country	Status	Area (km^2)	Current Funding
Offshore Islands	Antigua and Barbuda	Reserve / Unprotected	100	
Booby Cay	Bahamas	Unprotected	24	
Graham's Harbour	Bahamas	Unprotected	43	
Southern Great Lake	Bahamas	Unprotected	4	
Scotland District	Barbados	Unprotected	71	
Armando Bermudez National Park	Dominican Republic	National Park	810	
Ebano Verde Scientific Reserve	Dominican Republic	Scientific Reserve	357	
Enriquillo Lake	Dominican Republic	National Park	497	MacArthur funds for the Jaragua-Bahoruco-Enriquillo

Key Biodiversity Area	Country	Status	Area (km^2)	Current Funding
				Biosphere Reserve; MacArthur funds for plant conservation and sustainable management in Jaragua-Bahoruco-Enriquillo Biosphere Reserve; Aage V. Jensen Foundation funds for saving the treasures of the Caribbean
Haitises	Dominican Republic	National Park	626	
Loma Guaconejo	Dominican Republic	Scientific Reserve	24	USFWS funds for protection of biodiversity and the habitat of Bicknell's Thrush
Loma Quita Espuela	Dominican Republic	Scientific Reserve	95	
Nalga de Maco-Río Limpio	Dominican Republic	National Park / Unprotected	184	
PN Jose del Carmen Ramirez	Dominican Republic	National Park	764	
Beausejour/Grenville Vale	Grenada	Unprotected	1	
Mount Hartman	Grenada	National Park / Unprotected	1	
Black River Great Morass	Jamaica	Ramsar / Unprotected	178	MacArthur Foundation funds for biodiversity conservation
Bluefields	Jamaica	Unprotected	47	
Brazilleto Mountains	Jamaica	Protected Area	71	
Mandele Dry Forest	St. Lucia	Unprotected	9	
North-east Coast	St. Lucia	Unprotected	49	
Pointe Sable	St. Lucia	National Park	35	GEF/UNEP funds for mitigating the threat of invasive species; GEF/WB funds for implementation of pilot adaptation measures
Colonarie Forest Reserve	St. Vincent	Unprotected	18	
Cumberland Forest Reserve	St. Vincent	Forest Reserve	11	
Dalaway Forest Reserve	St. Vincent	Parrot Reserve / Unprotected	6	
Kingstown Forest Reserve	St. Vincent	Unprotected	9	
La Soufrière National Park	St. Vincent	Unprotected	56	
Mount Pleasant Forest Reserve	St. Vincent	Unprotected	13	
Richmond Forest Reserve	St. Vincent	Unprotected	34	

Conservation Corridors

Seven conservation corridors were identified for the Caribbean Islands Hotspot based on groupings of key biodiversity areas because of their importance for maintaining ecosystem resilience, ecosystem services values, and the health and richness of the hotspot's biological diversity. Of these corridors, six have been prioritized for CEPF investment as these harbor

priority key biodiversity areas, and are where civil society can have the greatest impact in maintaining and increasing ecosystem health and resilience, and functionality (Table 16). While there are threats to the seventh corridor, it is comparatively well managed and serviced by NGO and government agencies.

For the six corridors identified as priorities for CEPF investment, connectivity and sustainable management of these areas are key investment goals. The six corridors embrace 29 of the key biodiversity areas identified above. These are located in four countries: Jamaica, Dominican Republic, Haiti, and St Vincent and the Grenadines. The three corridors in Haiti and the Dominican Republic fall firmly within the broader geographic definition of the Caribbean Biological Corridor, presenting important opportunities to further complement and strengthen this regional initiative.

Table 16. Summary of Conservation Corridors for CEPF Investment in the Caribbean Islands Hotspot

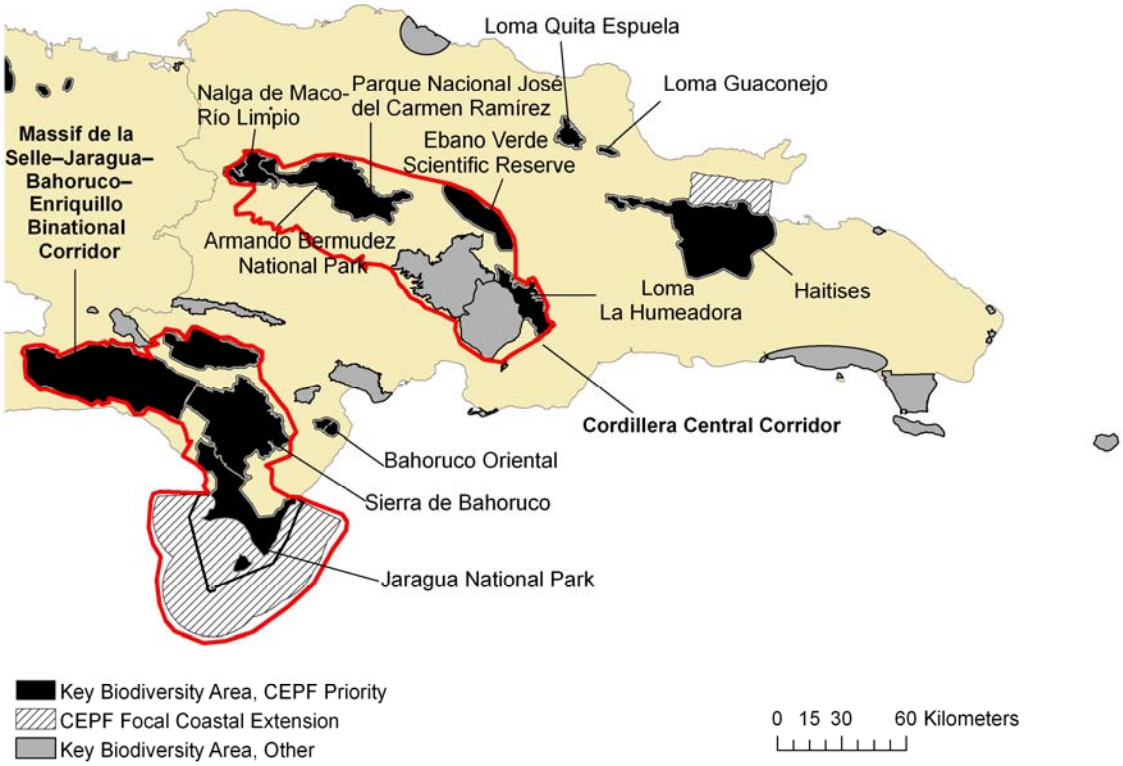
No	Conservation Corridor	Key Biodiversity Areas	Countries	Land Area (km^2)
1	Cockpit Country-North Coast Forest-Black River Great Morass	North Coast Forest; Cockpit Country; Catadupa; Litchfield Mountain-Matheson's Run; Black River Great Morass	Jamaica	2,458
2	Portland Bight Protected Area	Hellshire Hills; Portland Ridge and Bight; Brazilleto Mountains; Milk River	Jamaica	2,622
3	Massif du Nord	Plaisance; Morne Bailly; Citadelle	Haiti	1,078
4	Massif de la Selle – Jaragua–Bahoruco–Enriquillo binational corridor	Massif de la Selle (Haiti); Lago Enriquillo (Dominican Republic); Sierra de Bahoruco (Dominican Republic); Parque Nacional Jaragua (Dominican Republic)	Haiti; Dominican Republic	9,324
5	Cordillera Central	Parque Nacional Armando Bermúdez; Loma Nalga de Maco y Río Limpio; Parque Nacional José del Carmen Ramírez; Loma La Humeadora; Valle Nuevo; Reserva Científica Ébano Verde	Dominican Republic	6,517
6	Central Mountain Range	Colonarie Forest Reserve; Cumberland Forest Reserve; Dalaway Forest Reserve; Kingstown Forest Reserve; La Soufrière National Park; Mount Pleasant Forest Reserve; Richmond Forest Reserve	St. Vincent and the Grenadines	132

As shown in Table 15, 18 key biodiversity areas not encompassed by the corridors were also selected for investment. These sites do not lend themselves to corridor-level conservation because of their location, either on smaller islands or their isolation on the larger islands. Nonetheless, based on their biological importance, threat, ecosystem services value and the impact that civil society could have, these sites are regarded as high priorities for CEPF support.

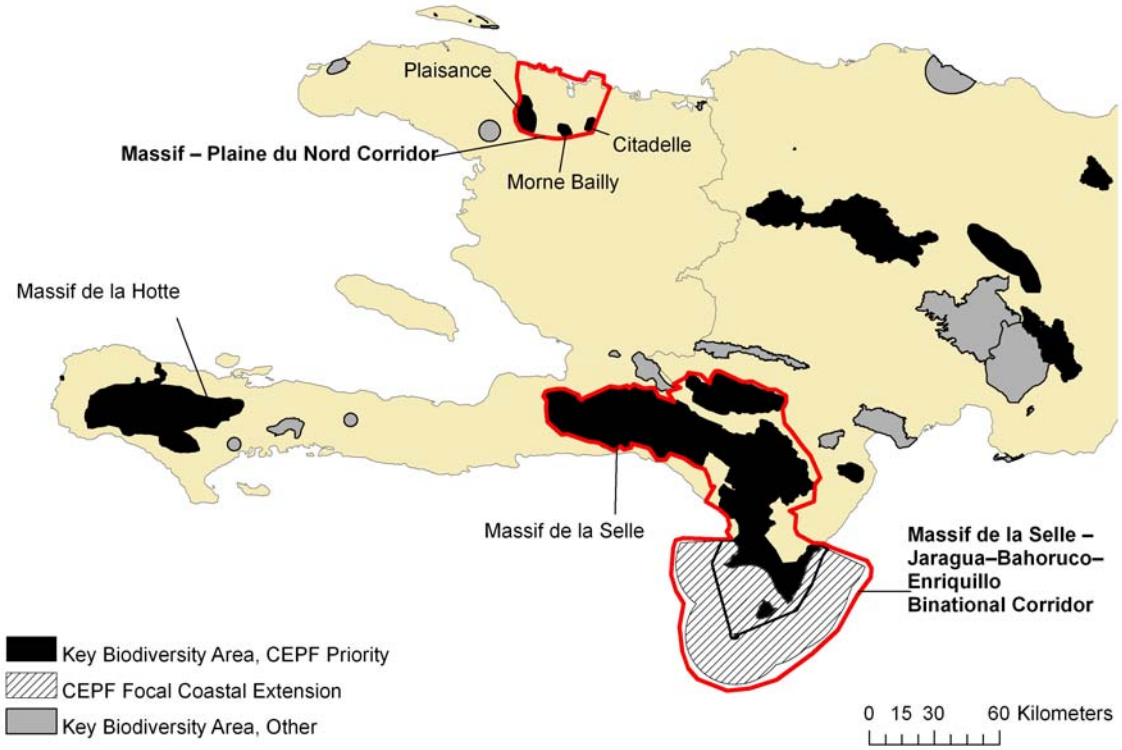
Figures 15-23. Maps of Key Biodiversity Areas and Corridors for CEPF Investment in the Caribbean Islands Hotspot

Note: The maps include a coastal extension for all key biodiversity areas and corridors with a coast, in recognition of how many of the sites are coastal and dependent on the health and resilience of the adjacent marine environment. As previously explained, CEPF will adopt the 12-nautical-mile territorial sea definition established by the U.N. Convention on the Law of the Sea as the outermost limit for CEPF attention and investment. This means that conservation actions pertaining to a coastal key biodiversity area can include, as necessary, the belt of ocean measured seaward from the coastal nation and subject to its sovereignty.

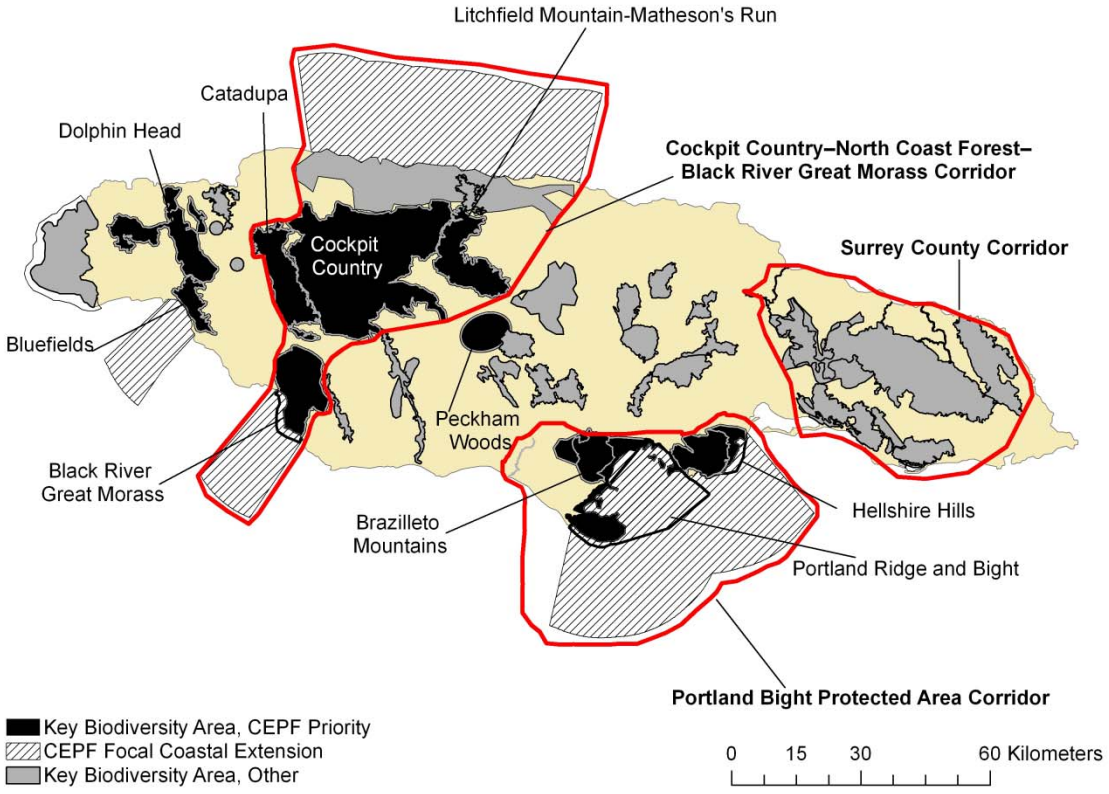
Dominican Republic: Key Biodiversity Areas and Corridors for CEPF Investment



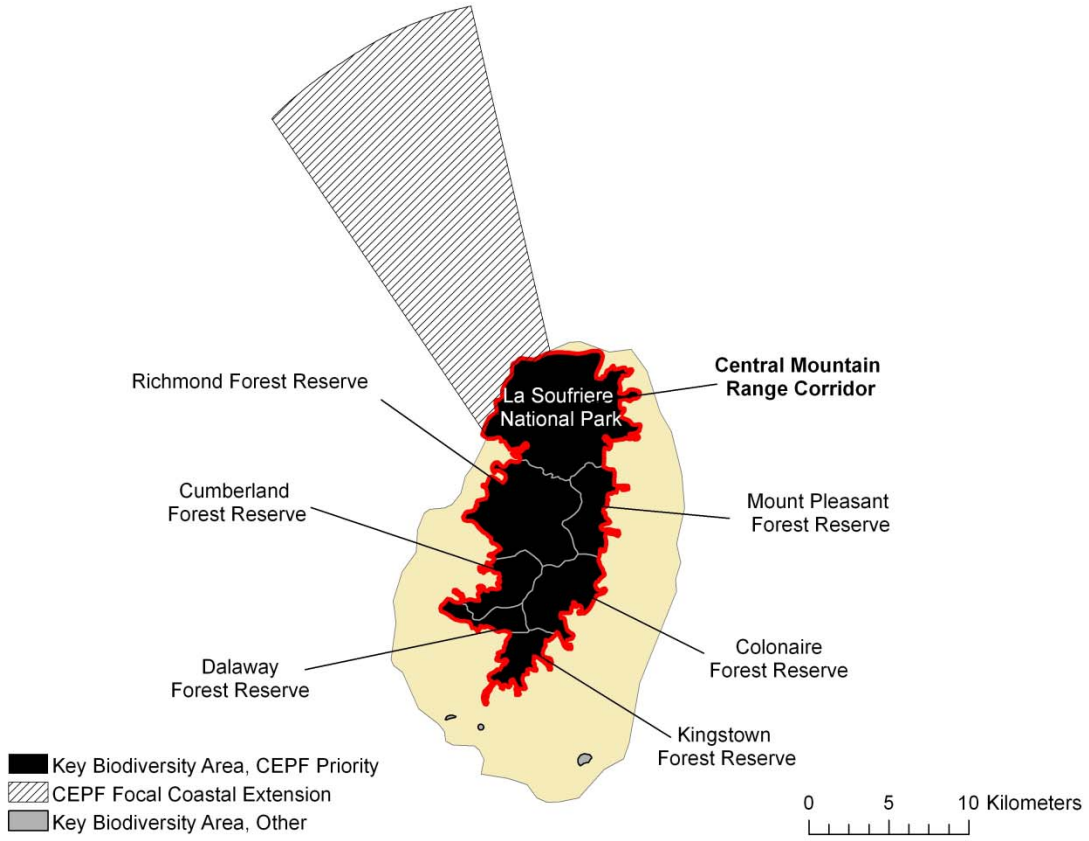
Haiti: Key Biodiversity Areas and Corridors for CEPF Investment



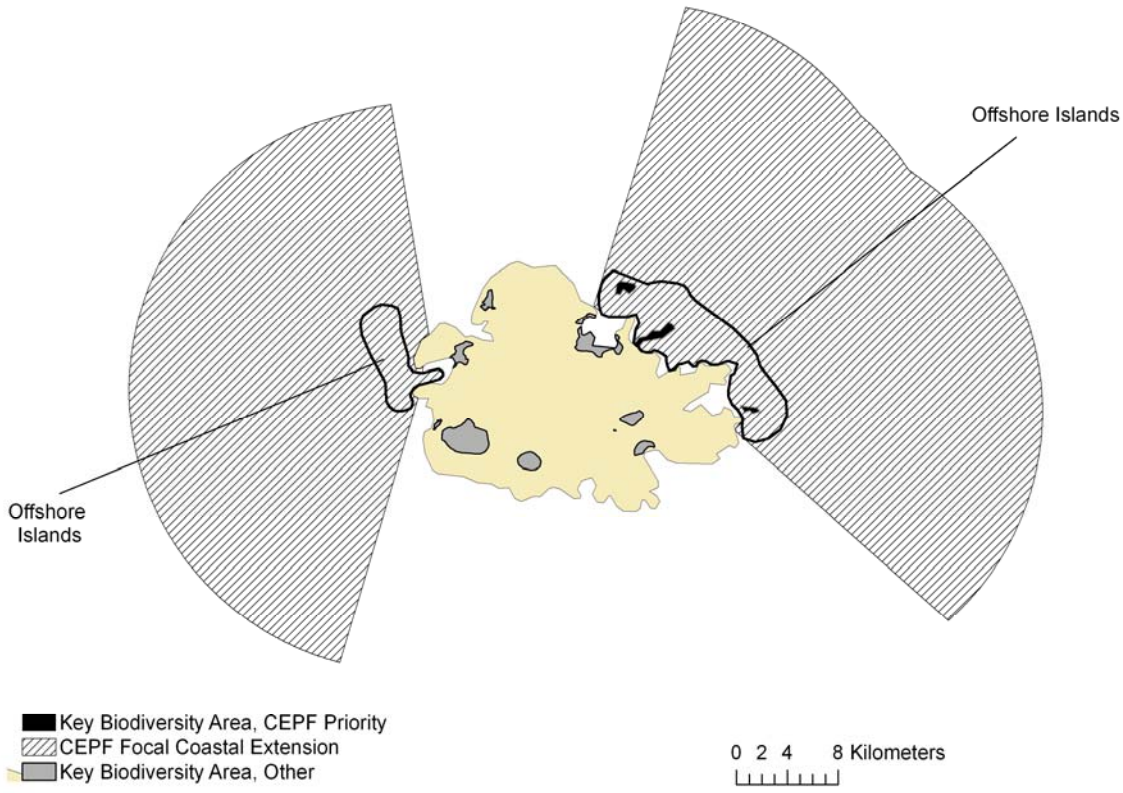
Jamaica: Key Biodiversity Areas and Corridors for CEPF Investment



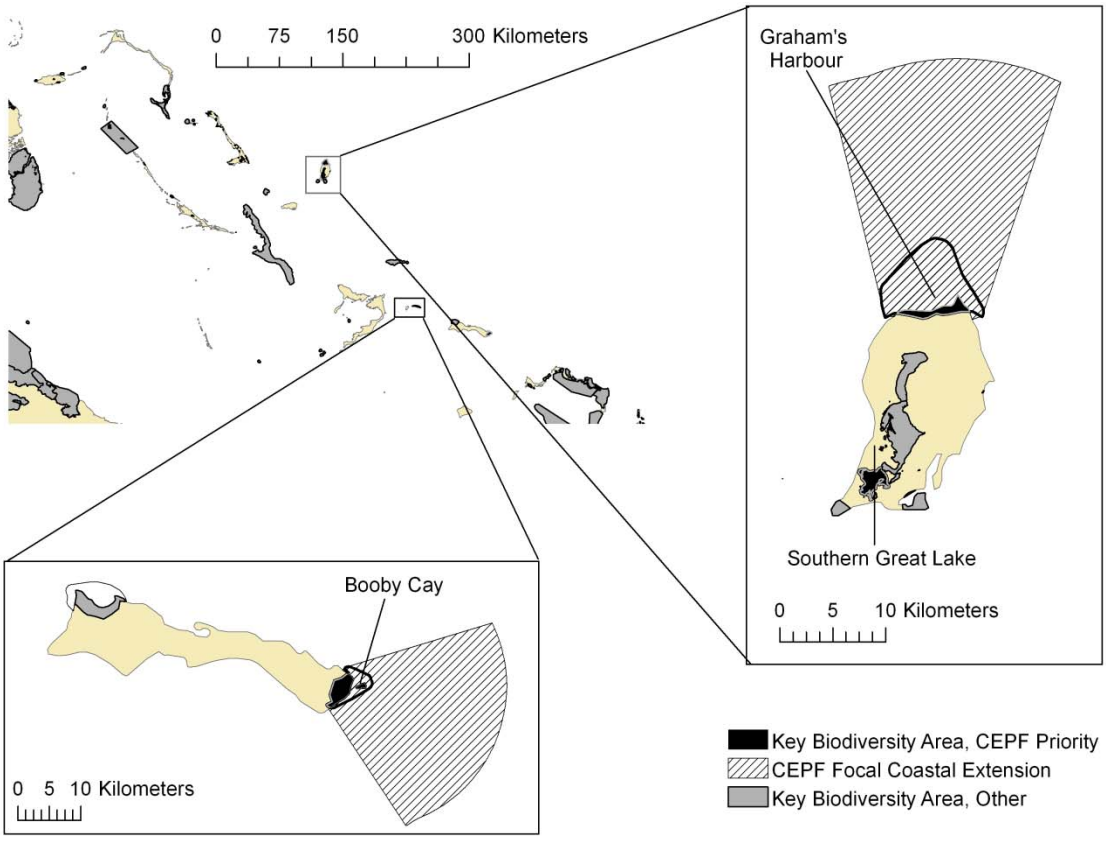
St. Vincent and the Grenadines: Key Biodiversity Areas and Corridors for CEPF Investment



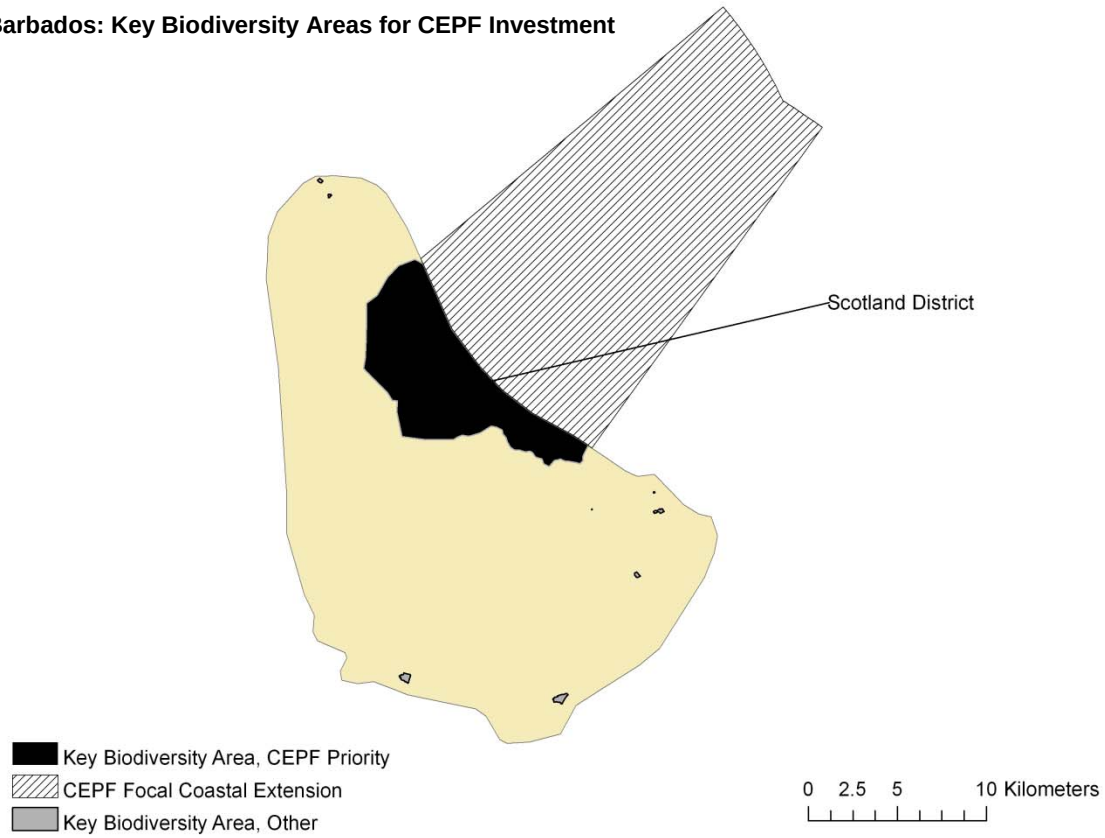
Antigua and Barbuda: Key Biodiversity Areas for CEPF Investment



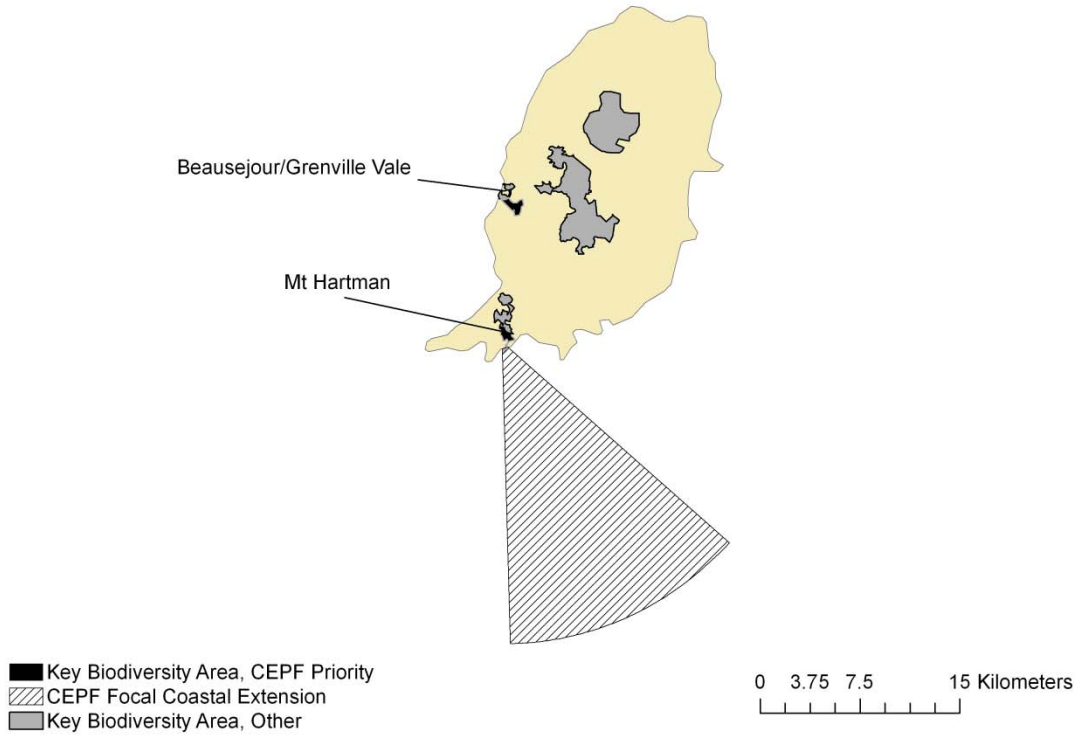
Bahamas: Key Biodiversity Areas for CEPF Investment



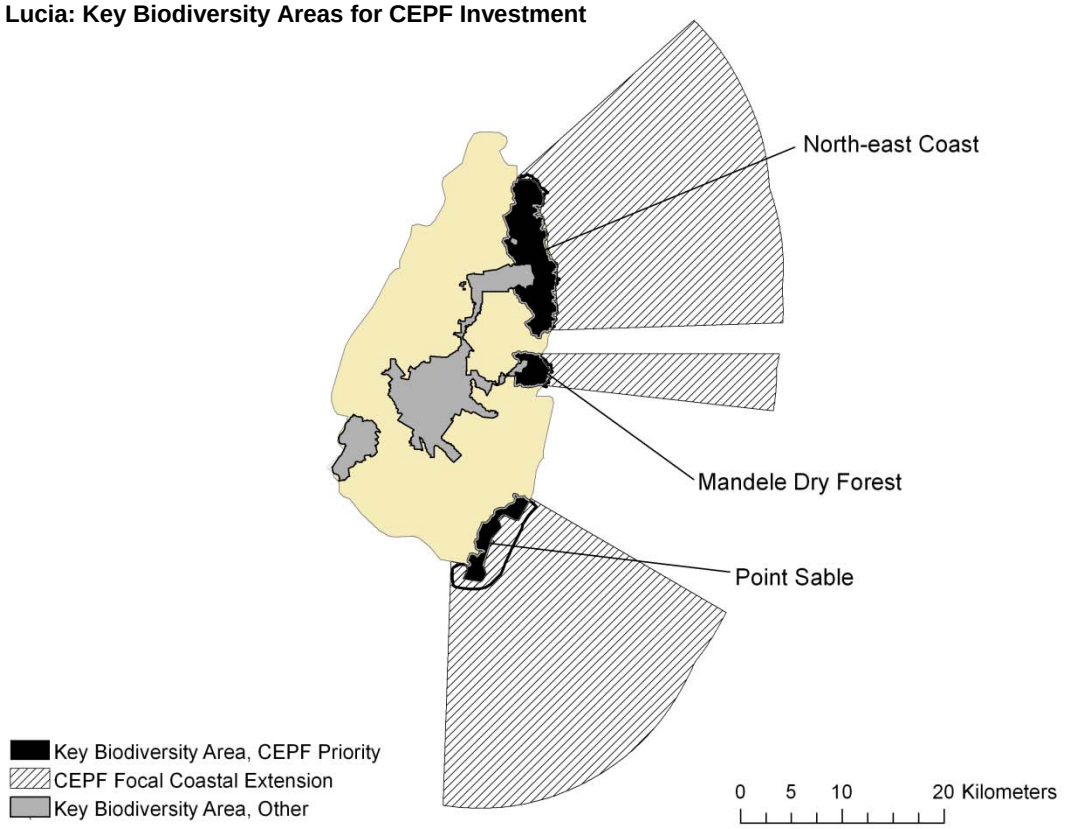
Barbados: Key Biodiversity Areas for CEPF Investment



Grenada: Key Biodiversity Areas for CEPF Investment



St. Lucia: Key Biodiversity Areas for CEPF Investment



Strategic Directions and Investment Priorities

The CEPF investment strategy comprises four strategic directions and associated investment priorities based on stakeholder consultations and the analysis of conservation outcomes, threats, current investments and other information detailed in this profile. The strategic directions and investment priorities are summarized in Table 17 and described in more detail in the text below.

In addition in the wake of the 2010 earthquake in Haiti, the CEPF Donor Council has approved extra funds for emergency support to Haitian civil society. This support has been incorporated as a fifth strategic direction entitled Provide emergency support to Haitian civil society to mitigate the impacts of the 2010 earthquake. See Additional CEPF Resources for the Caribbean Islands Biodiversity Hotspot for Post-earthquake Environmental Support to Haiti for further information, www.cepf.net/Documents/Final_Caribbean_EP.pdf (PDF - 53 KB).

Table 17. CEPF Strategic Directions and Investment Priorities for the Caribbean Islands Hotspot

Strategic Directions	Investment Priorities
1. Improve protection and management of 45 priority key biodiversity areas	1.1 Prepare and implement management plans in the 17 highest-priority key biodiversity areas
	1.2 Strengthen the legal protection status in the remaining 28 key biodiversity areas
	1.3 Improve management of invasive species in the 45 priority key biodiversity areas
	1.4 Support the establishment or strengthening of sustainable financing mechanisms
2. Integrate biodiversity conservation into landscape and development planning and implementation in six conservation corridors	2.1 Mainstream biodiversity conservation and ecosystem service values into development policies, projects and plans, with a focus on addressing major threats such as unsustainable tourism development, mining, agriculture and climate change
	2.2 Strengthen public and private protected areas systems through improving or introducing innovative legal instruments for conservation
	2.3 Prepare and support participatory local and corridor-scale land-use plans to guide future development and conservation efforts
	2.4 Promote nature-based tourism and sustainable agriculture and fisheries to enhance connectivity and ecosystem resilience and promote sustainable livelihoods
3. Support Caribbean civil society to achieve biodiversity conservation by building local and regional institutional capacity and by fostering stakeholder collaboration	3.1 Support efforts to build and strengthen the institutional capacity of civil society organizations to undertake conservation initiatives and actions
	3.2 Enable local and regional networking, learning and best-practice sharing approaches to strengthen stakeholder involvement in biodiversity conservation

4. Provide strategic leadership and effective coordination of CEPF investment through a regional implementation team	4.1 Build a broad constituency of civil society groups working across institutional and political boundaries toward achieving the shared conservation goals described in the ecosystem profile

Strategic Direction 1. Improve protection and management of 45 key biodiversity areas
CEPF has selected 45 key biodiversity areas in the Caribbean for direct, on-site conservation support. If these sites can be secured, a significant share of the hotspot's biological diversity and ecosystem services will be conserved. Seventeen of these key biodiversity areas have exceptional biological value. They cover 911,000 hectares and some top global priority lists for conservation. However, their on-site management presence is woefully inadequate or completely absent, making them highly vulnerable to further degradation. Furthermore, 28 of the 45 key biodiversity areas lack sufficient legal protection to ensure their viability. Investments may include interventions in the coastal, near-shore and marine habitats within the 12-nautical-mile territorial sea measured seaward from the actual key biodiversity area, if they relate to the conservation of the area. Strategic Direction 1 aims to strengthen key biodiversity area-level management capacity and the legal underpinning for conservation through four investment priorities:

1.1 Prepare and implement management plans in the 17 highest-priority key biodiversity areas
Seventeen of the key biodiversity areas designated as highest priority for conservation require significant management improvements. While some of these key biodiversity areas will receive funding from other donors, their management needs will continue to significantly outweigh these investments. Taken together, these 17 key biodiversity areas are home to a significant share of the Caribbean's biodiversity and ecosystem services. Under this investment priority, CEPF will support the design and implementation of management plans in those 17 key biodiversity areas that lack such plans. In key biodiversity areas where management plans already exist or have been prepared under this investment priority, CEPF will support the implementation of high-priority actions that are considered essential to maintain the long-term viability (especially in light of climate change considerations) of the site. Ensuring the long-term institutional and social sustainability of CEPF investments will be a major objective. The development and implementation of management plans will need to take into account a number of aspects accounted for in other parts of this strategy, including multi-stakeholder partnerships, sustainable livelihoods, territorial planning, invasive species control and climate change mitigation and adaptation.

1.2 Strengthen the legal protection status in the remaining 28 priority key biodiversity areas
The 28 of the 45 priority key biodiversity areas that are not covered in investment priority 1.1 require CEPF support in two distinct ways. First, more than half of these lack any legal protection or are under-protected. While it is possible that some key biodiversity areas can be designated as traditional public protected areas, it unlikely that all can receive such designation. In response, CEPF will assist in laying the groundwork for the adoption of more flexible approaches to conservation, such as new private protected areas, municipal reserves and co-management arrangements. Opportunities for strengthening the formal protection of key biodiversity areas will be pursued through dialogue, technical assistance assessments, land-use and management planning, and stakeholder consultations.

1.3 Improve management of invasive species in the 45 priority key biodiversity areas
Invasive alien species have been identified as among the most urgent threats to many of the 45 priority key biodiversity areas. The control and eradication of these invasive alien species, including the chytrid fungus, require a well-planned and coordinated response. CEPF will support

the preparation of coordinated action to confront threats from invasive alien species and the chytrid fungus in the most affected priority key biodiversity areas, and will stimulate partnerships for implementation. Collaboration and information sharing among NGOs, scientists and government institutions will be essential through formal and informal networks.

1.4 Support the establishment and strengthening of sustainable financing mechanisms
Financing is insufficient to support effective management of the priority key biodiversity areas in the long term. Many of the GEF- and other donor-funded protected area projects in the region have been focusing on trying to improve the financial sustainability of national protected area networks through the creation of protected area trust funds, debt-for-nature swaps and other approaches, but financing continues to be a challenge especially for the smaller or less visited protected areas that may need new, innovative local solutions involving greater community and business sector arrangements to ensure sustainability. This presents an important opportunity for CEPF to support nongovernmental organizations and private sector approaches to secure sustainable financing, such as through resource user fees, trust funds or payments for ecosystem services. Given this need, CEPF will support the establishment and strengthening of sustainable financing mechanisms in the region through technical assistance, assessments and stakeholder outreach. CEPF will facilitate the identification of partnerships for these mechanisms and their design, but will not provide funding specifically to capitalize endowment funds or payments for environmental services. Collaboration will be sought with the financing projects of GEF and other donors. Several potential opportunities exist for promoting market-based incentives, such as through the use of watershed services located in the key biodiversity areas, voluntary markets for carbon offset and potential funds for climate adaptation, as well as for supporting replication of successful approaches in the hotspot, such as tourism levies to fund conservation programs.

Strategic Direction 2. Integrate biodiversity conservation and ecosystem services into landscape and development planning and implementation in six conservation corridors
The six conservation corridors supported under Strategic Direction 2 encompass key biodiversity areas groupings identified as the highest priority for ensuring the longevity of the hotspot's biodiversity and for maintaining ecosystem services and resilience. CEPF's objectives are to maintain and increase connectivity, ensure sustainable management of the landscape, and increase the area of actual or potential natural habitat under protection where appropriate. Maintaining ecosystem functionality and resilience takes on particular significance in light of climate change. Ensuring that the enabling conditions exist to achieve these objectives provides the foundation for the four investment priorities under this strategic direction.

2.1 Mainstream biodiversity conservation and ecosystem service values into development policies, projects and plans, with a focus on addressing major threats such as unsustainable tourism development, mining, agriculture and climate change
CEPF will support civil society organizations to mainstream biodiversity conservation and ecosystem service values into regional and national policies and programs and private sector plans to promote a development path that is compatible with conservation. Grants will promote favorable policy frameworks where civil society can make the most difference and where the needs are the greatest in tourism, mining, agricultural development and climate change. Where necessary to ensure a strong analytical basis to achieve this investment priority, CEPF will fund assessments and consultations to identify priorities and opportunities for action, followed by support to develop and implement strategies to strengthen select policies, projects and plans. Grants will build awareness among decision makers of the substantial and cost-effective benefits that biodiversity conservation and provision of vital ecosystems offer for economic development, human well-being, and climate change mitigation and adaption. Targeted economic analysis will demonstrate the costs and benefits derived from the provision of ecosystem services and the

development of ecosystem service markets. The results of these and other relevant initiatives will be used by civil society to inform policy and program development.

With regard to climate change, CEPF will seek to integrate biodiversity conservation and ecosystem service values as essential pillars in national and regional climate change policies and programs. CEPF will also support innovative, small-scale climate change demonstration projects in or near a priority key biodiversity areas that illustrate the benefits of biodiversity conservation and ecosystem services for adaption and mitigation.

2.2 Strengthen public and private protected areas systems through improving or introducing innovative legal instruments for conservation

The profile finds that 28 of the 45 priority key biodiversity areas selected for CEPF funding lack any legal protection or are significantly under-protected, and that the declaration of traditional public protected areas may not be a viable option for all of these key biodiversity areas. While private protected areas, co-management and other new approaches to conserving these areas may be promising, the legal frameworks and local capacity to institute such approaches are insufficient. CEPF will enable civil society to help strengthen protected areas policies and systems using a broad and flexible range of tools. Such efforts will include policy analysis to identify gaps and options, and development and adoption of recommendations to strengthen protected areas networks through innovative legal instruments.

2.3 Prepare and support participatory local and corridor-scale land-use plans to guide future development and conservation efforts

Caribbean partners identify poor land-use planning and inappropriate agricultural and tourism development as major contributors to environmental degradation. Fortunately, opportunities to promote sustainable development in the corridors exist. For instance, Jamaica has started to prepare land-use plans at the district level, although local civil society participation is reported to be weak. Similar efforts in Haiti are considered a high priority by local stakeholders for the corridors. The need to integrate measures to respond to climate change is also essential. To respond to these opportunities and needs, CEPF will support the planning and adoption of local and corridor-level land-use plans to create consensus by stakeholders on a long-term vision for the development and conservation of their corridors and key biodiversity areas.

2.4 Promote nature-based tourism and sustainable agriculture and fisheries to enhance connectivity and ecosystem resilience and support sustainable livelihoods

CEPF has the opportunity to support innovative efforts to involve the private sector and local communities in conservation that demonstrate links between conservation and sound development. While several efforts have been undertaken to promote ecotourism and sustainable agriculture and fisheries, insufficient attention has been paid to scaling these initiatives up to the extent required to play a meaningful role in threats amelioration. Grants will support conservation-based enterprises that show promise of generating environmentally sustainable sources of income for communities that otherwise could be agents of environmental degradation, focusing on nature-based tourism, conservation coffee and cacao, and sustainable fisheries. Projects will demonstrate direct and tangible benefits for biodiversity and communities. Grants may also fund the identification and sharing of best practices and promotion of greater collaboration in vital areas such as marketing.

Strategic Direction 3. Support Caribbean civil society to achieve biodiversity conservation by building local and regional institutional capacity and by fostering stakeholder collaboration

Caribbean partners have identified limited civil society capacity and collaboration as significant obstacles to achievement of conservation in the Caribbean Islands Hotspot. Many of the Caribbean's environmental and community groups are still often working in relative isolation from each other, with weak networks due to competition between groups for limited funding, and a project-centered approach to much of their work. In the smaller islands, organizations are unable to support staff and memberships large enough to maintain expertise in needed disciplines. In spite of past investment in NGO capacity building in the Caribbean there are still significant capacity gaps suggesting that new approaches are needed. This strategic direction proposes to strengthen the foundation upon which Caribbean NGOs are based, and to support innovation that will lead to a sustainable and self-reliant environmental civil society that is engaged in conservation on a variety of levels.

3.1 Support efforts to build and strengthen the institutional capacity of civil society organizations to undertake conservation initiatives and actions

Caribbean civil society organizations have an important role to play in planning, promoting and implementing biodiversity conservation throughout the region, on almost every level. While a number of organizations are actively engaged in conservation initiatives, the full potential of Caribbean civil society is far from being realized. Many of the region's conservation groups are small and under-capacitated, and some are quite isolated, especially in the smaller islands of the Lesser Antilles and in Haiti. Limited administrative, managerial, financial and technical capacity is a challenge faced by numerous organizations. Many have a small number of staff, and insufficient funds to employ the suite of positions needed to maintain a fully functional organization. In this context, the sustainability of such organizations is in doubt, and the sustainability of their actions is similarly tenuous. CEPF will support efforts aimed at strengthening the institutional capacity of those Caribbean conservation organizations that have an important role to play in achieving CEPF's strategic directions, by providing funds for comprehensive institutional capacity-building packages that aim to build institutional and technical capacity required to undertake biodiversity conservation. CEPF funds will not simply be directed toward selected staff and their capacity needs, but rather will be geared toward a holistic institution-wide approach to institutional strengthening that will lead to self-reliance and sustainability, and that in turn will assist in achievement and sustainability of the other investment priorities in this strategy.

3.2 Enable local and regional networking, learning and best-practice sharing approaches to strengthen stakeholder involvement in biodiversity conservation

By nature of its geography, many of the Caribbean island states are small and isolated. These islands often have small populations and consequently NGOs often have difficulty finding staff with the requisite skill and experience to conduct conservation activities at the appropriate professional level. Furthermore, civil society conservation efforts have lacked strong collaborative and regional approaches, which have diminished their long-term effectiveness and are imperative given the small and under-capacitated islands in this hotspot. This investment priority will contribute to collaboration and coordination of conservation within the hotspot, and engender a true networking spirit among participating organizations. CEPF investments will focus on new approaches (e.g. informal and formal networks and alliances, and collaborative action and learning) to build capacity and cooperation in strategic areas of hotspot importance, including tourism and mining development, invasive species, climate change, site-based conservation, and policy and legislation. CEPF funds will support projects that stimulate learning and catalyze conservation action by civil society actors, and will focus on best practices relevant

to the Caribbean and the specific barriers and challenges confronting NGOs. While IP 3.1 will seek to build the institutional capacity of selected civil society organizations in the Caribbean, another tactic is required to supply civil society organizations with the specialized technical expertise that they might need on an occasional basis. Recognizing that some islands may never be able to have sufficient civil society capacity in some needed areas of technical expertise, CEPF will also support efforts to establish regional networking approaches that can meet local needs.

Strategic Direction 4. Provide strategic leadership and effective coordination of CEPF investment through a regional implementation team

An independent evaluation of the global CEPF program found that CEPF regional implementation teams are particularly effective with the support of the CEPF grant directors in linking the key elements of comprehensive, vertically integrated portfolios such as large anchor projects, smaller grassroots activities, policy initiatives, governmental collaboration and sustainable financing. The responsibilities of these teams, formerly known as coordination units, have now been standardized to capture the most important aspects of their function.

In every hotspot approved for investment as of July 2007, CEPF will support a regional implementation team to convert the plans in the ecosystem profile into a cohesive portfolio of grants that exceeds in impact the sum of their parts. Each regional implementation team will consist of one or more civil society organizations active in conservation in the region. For example, a team could be a partnership of civil society groups or could be a lead organization with a formal plan to engage others in overseeing implementation, such as through an inclusive advisory committee.

The regional implementation team will be selected by the CEPF Donor Council based on an approved terms of reference, competitive process and selection criteria available at www.cepf.net. The team will operate in a transparent and open manner, consistent with the CEPF mission and all provisions of the CEPF Operational Manual. Organizations that are members of the Regional Implementation Team will not be eligible to apply for other CEPF grants within the same hotspot. Applications from formal affiliates of those organizations that have an independent operating board of directors will be accepted, and will be subject to additional external review.

4.1 Build a broad constituency of civil society groups working across institutional and political boundaries toward achieving the shared conservation goals described in the ecosystem profile

The regional implementation team will provide strategic leadership and local knowledge to build a broad constituency of civil society groups working across institutional and political boundaries toward achieving the conservation goals described in the ecosystem profile. The team's major functions and specific activities will be based on an approved terms of reference. Major functions of the team will be to:

- Act as an extension service to assist civil society groups in designing, implementing, and replicating successful conservation activities.
- Review all grant applications and manage external reviews with technical experts and advisory committees.
- Award grants up to $20,000 and decide jointly with the CEPF Secretariat on all other applications.
- Lead the monitoring and evaluation of individual projects using standard tools, site visits, and meetings with grantees, and assist the CEPF Secretariat in portfolio-level monitoring and evaluation.
- Widely communicate CEPF objectives, opportunities to apply for grants, lessons learned, and results.

- Involve the existing regional program of the RIT, CEPF donor and implementing agency representatives, government officials, and other sectors within the hotspot in implementation.
- Ensure effective coordination with the CEPF Secretariat on all aspects of implementation.

Specific activities and further details are available in the CEPF Regional Implementation Team Terms of Reference and Selection Process on www.cepf.net.

SUSTAINABILITY

An important element of the CEPF Strategic Framework is that the initiatives supported by CEPF grants are ecologically, socially, institutionally and financially sustainable over a longer term than the five years of the granting process. This profile has incorporated sustainability into its investment priorities in order to meet that goal, and ultimately to assure the survival of viable populations of the globally threatened species and ecosystems upon which the people of the Caribbean depend on. CEPF will achieve sustainability by providing strong support for civil society groups so that they will maintain a long-term presence in the communities around priority corridors and in the political processes that affect them.

CEPF funding will play a critical role in Caribbean conservation by supporting civil society to complement larger funding initiatives coming from multilateral and bilateral sources to government agencies in the region. In the priority conservation corridors where CEPF efforts will be focused, civil society groups will carry out on-the-ground actions in key biodiversity areas and buffer zones to ensure sustainability in the long term. The Caribbean's most important KBAs will be under improved management and protection due to CEPF investments. CEPF will ensure that the 17 highest-priority sites have management plans that are prepared in close consultation with local stakeholders and will ensure that site-based investments are strategically aligned to achieve long-term conservation gains. New sites will be brought under formal protection status for the first time, and innovative sustainable financing schemes will be sought to pay for conservation needs. To complement these efforts, community-based sustainable agriculture, fisheries and ecotourism ventures will allow local people to manage their natural resources in a way that generates sustainable sources of income and food. The preparation of participatory local and corridor-scale development plans will serve as another tool by which future development efforts are undertaken in support of sustainable resources management and conservation.

Institutional and financial sustainability will also be sought by mainstreaming biodiversity conservation and ecosystem services into development planning, policy and programming at all levels of decisionmaking. Current attention on climate change provides a critical opening by which grants will seek to raise awareness of the importance of ecosystem services and integrate these services into policies affecting important sectors of Caribbean society and economy, such as tourism, agriculture and climate change. Policies that support the declaration of non-traditional measures to achieve site-based protection (such as private protection) will be sought. CEPF will support civil society organizations to help internalize conservation in national planning and policy development in ways that will benefit both people and biodiversity.

This profile recognizes the unique challenges for these organizations in small island states and includes investment priorities to help overcome these. CEPF funds will strengthen the institutional capacity of civil society organizations and encourage their close collaboration in order to carry out their conservation mission in the Caribbean over the long term.

CEPF staff and the Regional Implementation Team will work closely with civil society partners in the Caribbean to insure that ecological, social, institutional and financial sustainability are incorporated into activities supported and that these elements are considered throughout the planning, implementation and evaluation of these efforts. Underpinning all CEPF efforts will be attention to mitigate the most significant current and looming threats to the Caribbean's ecosystems, ranging from climate change to invasive species, agricultural encroachment, unsustainable tourism and mining.

CONCLUSION

The development of this comprehensive ecosystem profile and the CEPF investment strategy was made possible by extensive consultation with stakeholders. National/regional coordinators were engaged to gather information from their respective areas, and a series of workshops with stakeholders further enriched this process. The authors believe that this work represents a fair consensus and that Caribbean partners will enthusiastically endorse it and carry out its provisions.

The Caribbean Islands Hotspot is one of the world's greatest centers of biodiversity and endemism, an archipelago of habitat-rich tropical and semi-tropical islands, yet its biodiversity and the natural services its provides are highly threatened. This astonishing biodiversity is threatened by invasive species, uncontrolled development of tourism, mining, and other activities, and severe weather exacerbated by climate change. Although the islands have protected areas systems, most are inadequately managed and some important areas lack protection. A total of six conservation corridors and 45 key biodiversity areas were defined as targets for CEPF investment. CEPF has identified four strategic directions to guide investment in this hotspot. Adherence in this strategy will ensure that CEPF funds are invested in the most appropriate and effective manner and will generate significant conservation results that will not only complement the actions of other stakeholders in the Caribbean but also enable a significant expansion of strategic conservation effort for the benefit of all.

Caribbean Islands Hotspot Ecosystem Profile: Logical Framework for CEPF Investments

Objective	Targets	Means of Verification	Important Assumptions
Engage civil society in the conservation of globally threatened biodiversity through targeted investments with maximum impact on the highest conservation and ecosystem services priorities	NGOs and civil society actors from CEPF eligible countries, with an emphasis on the six priority conservation corridors and 45 key biodiversity areas, effectively participate in conservation programs guided by the ecosystem profile. Development plans, projects and policies which influence the six conservation corridors and 45 key biodiversity areas mainstream biodiversity and ecosystem services, with a focus on tourism, mining and agriculture. 17 Key Biodiversity Areas covering 911,000 hectares have strengthened protection and management as guided by sustainable management plans. At least 20 percent of under-protected priority key biodiversity areas (at least six) brought under new and/or strengthened protection status. Strategic areas of the production landscape of six conservation corridors under improved management for biodiversity conservation and ecosystem services. The Caribbean ecosystem profile influences and complements other donor's investment strategies.	Grantee and RIT performance reports Annual portfolio overview reports; portfolio mid-term and final assessment	The CEPF grants portfolio will effectively guide and coordinate conservation action in the Caribbean Islands Hotspot

Intermediate Outcomes	Intermediate Indicators	Means of Verification	Important Assumptions
Outcome 1. **Improve protection and management of 45 priority Key Biodiversity Areas** **$3,050,000**	Number of hectares in key biodiversity areas and number of key biodiversity areas (and percent) with demonstrable improvements/strengthening in their protection and management as guided by a sustainable management plan.	Grantee and RIT performance reports and site visits Protected Areas Tracking Tool (SP1 METT)	Government agencies are interested and willing to support civil society efforts to conserve KBAs and corridors. Local communities are

Intermediate Outcomes	Intermediate Indicators	Means of Verification	Important Assumptions
	Number of hectares brought under new or upgraded protection. Number of sustainable financing mechanisms established and/or strengthened with initial capital secured. Number of co-management arrangements established or supported. Percent and number of grants that enable effective stewardship by local communities for biodiversity and ecosystem conservation.	Sustainable financing agreements and accounts Global IBA/KBA monitoring framework Formal legal declarations or community agreements designating new protected areas Management plans and reports on management activities	sufficiently organized, have enough capacity and are willing to participate in these activities. Civil society organizations have adequate capacity and are interested in engaging in conservation and management of KBAs and corridors. Private sector is willing to engage and participate in joint-ventures.
Outcome 2. **Integrate biodiversity conservation into landscape and development planning and implementation in six conservation corridors.** **$1,900,000**	Number of policies, projects and plans incorporating ecosystem services, climate change and biodiversity conservation. Number of hectares in production landscapes with improved management for biodiversity conservation Number of policies formulated and adopted to strengthen public and private protected areas systems. Number of public-private partnerships that mainstream biodiversity in the agriculture, tourism and mining sectors. Number of co-management arrangements established or supported. Number of projects located outside protected areas that integrate biodiversity conservation in management practices.	Grantee and RIT performance reports and site visits Productive Landscape Tracking Tool (SP2 METT) Management/co-management/stewardship agreements or contracts National and regional policy documents Public – private partnership agreements/MOUs/contracts	Decision-makers are receptive and sympathetic to conservation and sustainable-development of the priority KBAs and corridors Targeted decision-makers are in a position to influence select policies and projects Capacity is sufficient and can be built to enable the strategic, targeted “informing” of decision makers. National legislation includes or allows for the establishment of sustainable funding mechanisms. Civil society organizations with sufficient capacity to engage in advocacy at the national and regional decision-making level.
Outcome 3. **Caribbean civil society supported to achieve biodiversity conservation by building local and**	Number of civil society organizations with strengthened institutional capacity. Number of local and regional initiatives supported	Grantee and RIT performance reports and site visits	Civil society organizations are committed to maintaining lines of collaboration and communication with local,

Intermediate Outcomes	Intermediate Indicators	Means of Verification	Important Assumptions
regional institutional capacity and by fostering stakeholder collaboration **$900,000**	to strengthen stakeholder involvement in biodiversity conservation		national and regional entities.
Outcome 4. **A Regional Implementation Team provides strategic leadership and effectively coordinates CEPF investment in the Caribbean Islands Hotspot** **$650,000**	Regional Implementation Team performance in fulfilling the approved Terms of Reference Number of groups receiving grants that achieve a satisfactory score on final performance scorecard	Grantee and RIT performance reports CEPF Secretariat supervision missions and monitoring	Local, national and regional stakeholders remain interested in CEPF RIT good contacts/relations with Caribbean civil society groups
Outcome 5. **Emergency support provided to Haitian civil society to mitigate the impacts of the 2010 earthquake** **$400,000**	# of actions take to prevent destruction of forests in Massif de la Selle and Massif de la Hotte Environmental Network Resource Center established # of reconstruction and development policies and plans that incorporate environmental concerns	Grantee and RIT performance reports	Haiti will not suffer another large-scale natural disaster
Strategic Funding Summary	**Amount**		
Total Budget:	$6,900,000		

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APPENDICES

Appendix 1…….120
Key Biodiversity Areas in the Caribbean Islands Hotspot

Appendix 2…….130
Examples of Ecosystem Services and Their Contribution to Economic Development in the Caribbean Islands Hotspot

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Appendix 1. Key Biodiversity Areas in the Caribbean Islands Hotspot (names in bold are priorities for CEPF investment)

No.	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Sea Turtles	Plants	Key Biodiversity Area within a Priority Corridor
	ANGUILLA (to U.K.)	**0**	**0**	**6**	**0**	**0**	**0**	
1	Cove Pond	0	0	1	0	0	0	
2	Eastern Anguilla	0	0	1	0	0	0	
3	Grey Pond	0	0	1	0	0	0	
4	Katouche Canyon	0	0	1	0	0	0	
5	Long Pond	0	0	1	0	0	0	
6	Scrub Island	0	0	1	0	0	0	
	ANTIGUA and BARBUDA	**0**	**9**	**1**	**0**	**1**	**2**	
7	Bethesda Dam	0	1	0	0	0	0	
8	Christian Cove	0	1	0	0	0	0	
9	Codrington Lagoon and the Creek	0	1	0	0	0	0	
10	Fitches Creek Bay	0	1	0	0	0	0	
11	Hanson's Bay - Flashes	0	1	0	0	0	0	
12	McKinnons Salt Pond	0	1	0	0	0	0	
13	**Offshore Islands**	0	1	1	0	1	1	
14	Potsworks dam	0	1	0	0	0	0	
15	Valley Church Bay	0	1	0	0	0	0	
16	Wallings Forest	0	0	0	0	0	1	
	ARUBA (to Netherlands)	**1**	**0**	**1**	**0**	**0**	**0**	
17	Arikok National Park	1	0	1	0	0	0	
	BAHAMAS	**2**	**10**	**14**	**0**	**1**	**1**	
18	Allan's Cays	0	0	1	0	0	0	
19	Bitter Guana Cay	0	0	1	0	0	0	
20	**Booby Cay**	0	0	1	0	0	0	
21	Cat Island Wetlands	0	1	0	0	0	0	
22	Cay Sal	0	0	0	0	1	0	
23	Driggs Hill to Mars Bay	0	0	1	0	0	0	
24	East Plana Key	1	0	0	0	0	0	
25	Exuma Cays Land and Sea Park	1	0	1	0	0	0	
26	**Graham's Harbour**	0	0	1	0	0	0	
27	Great Inagua	0	1	0	0	0	0	
28	Green Cay	0	0	1	0	0	0	

No.	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Sea Turtles	Plants	Key Biodiversity Area within a Priority Corridor
29	Grog Pond	0	1	0	0	0	0	
30	Guana Cays	0	0	1	0	0	0	
31	Harrold and Wilson Ponds National Park	0	1	0	0	0	0	
32	Lee Stocking Island	0	1	0	0	0	0	
33	Long Island and Hog Cay	0	1	0	0	0	0	
34	Lucayan National Park	0	1	0	0	0	0	
35	Mangrove Cay	0	0	1	0	0	0	
36	Red Bays	0	1	0	0	0	0	
37	San Andros Pond	0	1	0	0	0	0	
38	San Salvador	0	0	0	0	0	1	
39	South Andros Island	0	0	1	0	0	0	
40	**Southern Great Lake**	0	0	1	0	0	0	
41	Stafford Creek to Andros Town	0	1	1	0	0	0	
42	White Bay, Noddy, North Adderley and Leaf Cays	0	0	1	0	0	0	
43	White Cay	0	0	1	0	0	0	
	BARBADOS	**1**	**0**	**1**	**0**	**4**	**0**	
44	Bath Beach	0	0	0	0	1	0	
45	Hilton Beach	0	0	0	0	1	0	
46	**Scotland District**	1	0	1	0	1	0	
47	South Coast Beaches	0	0	0	0	1	0	
	CAYMAN ISLANDS (to U.K.)	**0**	**4**	**7**	**0**	**0**	**1**	
48	Bluff Forest	0	0	1	0	0	1	
49	Booby Pond Nature Reserve	0	1	1	0	0	0	
50	Botanic Park and Salina Reserve	0	1	1	0	0	0	
51	Central Mangrove Wetland	0	1	0	0	0	0	
52	Crown Wetlands	0	1	1	0	0	0	
53	Eastern Dry Forest	0	0	1	0	0	0	
54	Franklin's Forest	0	0	1	0	0	0	
55	Sparrowhawk Hill	0	0	1	0	0	0	
	CUBA	**0**	**28**	**0**	**0**	**0**	**0**	
56	Alejandro de Humboldt		**1**					
57	Alturas de Banao		**1**					
58	Cayería Centro-Oriental de Villa Clara		**1**					
59	Cayo Sabinal, Ballenatos y		**1**					

No.	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Sea Turtles	Plants	Key Biodiversity Area within a Priority Corridor
	Manglares de la Bahía de Nuevitas							
60	Cayos Romano-Cruz-Megano Grande		**1**					
61	Cienaga de Lanier y Sur de la Isla de la Juventud		**1**					
62	Ciénaga de Zapata		**1**					
63	Delta del Cauto		**1**					
64	Delta del Mayarí		**1**					
65	Desembarco del Granma		**1**					
66	Gibara		**1**					
67	Gran Humedal del Norte de Ciego de Ávila		**1**					
68	Gran Piedra - Pico Mogote		**1**					
69	Hatibonico - Baitiquirí - Imías		**1**					
70	Humedal Sur de Pinar del Río		**1**					
71	Humedal Sur de Sancti Spiritus		**1**					
72	La Mensura		**1**					
73	Las Picúa- Cayo del Cristo		**1**					
74	Limones-Tuabaquey		**1**					
75	Mil Cumbres		**1**					
76	Peninsula de Guanahacabibes		**1**					
77	Pico Cristal		**1**					
78	Río Máximo		**1**					
79	Siboney - Juticí		**1**					
80	Sierra del Chorrillo		**1**					
81	Sierra del Rosario		**1**					
82	Topes de Collantes		**1**					
83	Turquino-Bayamesa		**1**					
	DOMINICA	**0**	**2**	**2**	**2**	**0**	**2**	
84	Cochrane	0	0	0	0	0	1	
85	Morne Diablotin National Park	0	1	1	1	0	0	
86	Morne Trois Pitons National Park	0	1	0	1	0	1	
87	Point Des Foux	0	0	1	0	0	0	
	DOMINICAN REPUBLIC	**16**	**20**	**9**	**25**	**0**	**25**	
88	Arroyo Lebrón, El Seybo	0	0	0	0	0	1	
89	Bahía de las Calderas	0	1	1	0	0	1	

No.	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Sea Turtles	Plants	Key Biodiversity Area within a Priority Corridor
90	**Bahoruco Oriental**	1	1	0	1	0	1	
91	Cabo Engaño	0	0	0	0	0	1	
92	Cerros de Chacuey- Dajabon	0	0	0	0	0	1	
93	Charcos de Damajagua, Imbert	1	0	0	1	0	0	
94	Gran Estero	0	0	1	1	0	1	
95	Honduras	0	1	0	1	0	1	
96	Hoyo Claro-Hoyo Azul	0	0	0	0	0	1	
97	Humedales del Bajo Yuna	1	0	0	0	0	0	
98	Isabel de Torres	0	0	0	1	0	1	
99	Jaiqui Picado, Moncion	1	0	0	0	0	0	
100	**Lago Enriquillo**	0	1	1	1	0	1	Yes
101	Laguna Bávaro	0	0	0	1	0	0	
102	Laguna Cabral	0	1	1	1	0	1	
103	Laguna Limón	0	1	0	0	0	0	
104	**Loma Guaconejo**	1	1	0	1	0	0	
105	**Loma La Humeadora**	0	1	1	1	0	1	Yes
106	**Loma Nalga de Maco y Río Limpio**	1	1	0	1	0	1	Yes
107	**Loma Quita Espuela**	1	1	0	1	0	0	
108	**Los Haitises**	1	1	0	1	0	1	
109	Los Quemados	0	0	0	1	0	1	
110	**Parque Nacional Armando Bermúdez**	1	1	0	1	0	1	Yes
111	Parque Nacional del Este	1	1	1	1	0	1	
112	**Parque Nacional Jaragua**	1	1	1	1	0	1	Yes
113	**Parque Nacional Jose del Carmen Ramirez**	0	0	0	1	0	0	Yes
114	Pico de Diego de Ocampo	0	0	0	1	0	0	
115	Promontorio de Cabrera	1	0	0	0	0	0	
116	Punta Cana	0	1	0	1	0	1	
117	**Res Científica Ébano Verde**	1	1	0	1	0	1	Yes
118	Rio Anamuya, La Altagracia	0	0	0	0	0	1	
119	**Sierra de Bahoruco**	1	1	1	1	0	1	Yes
120	Sierra de Neyba	1	1	0	1	0	1	
121	Sierra Martín García	0	1	1	1	0	1	
122	**Valle Nuevo**	1	1	0	1	0	1	Yes
	GRENADA	**0**	**5**	**0**	**2**	**2**	**0**	

No.	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Sea Turtles	Plants	Key Biodiversity Area within a Priority Corridor
123	Bathway Beach	0	0	0	0	1	0	
124	**Beausejour/Grenville Vale**	0	1	0	0	0	0	
125	Grand Etang	0	0	0	1	0	0	
126	Levera Beach	0	0	0	0	1	0	
127	**Mount Hartman**	0	1	0	0	0	0	
128	Mount Saint Catherine	0	0	0	1	0	0	
129	Perseverance	0	1	0	0	0	0	
130	Woodford	0	1	0	0	0	0	
131	Woodlands	0	1	0	0	0	0	
	GUADELOUPE (to France)	**2**	**2**	**3**	**1**	**1**	**3**	
132	îlets de la Petite-Terre	0	0	1	0	0	1	
133	Falaises Nord et Îlet de Vieux-Fort de Marie-Galante	0	0	0	0	0	1	
134	Gallery Forest of Baie-Mahault	1	0	0	0	0	0	
135	Grand Cul-de-Sac Marin's eastern coastline	0	1	0	0	0	0	
136	La Désirade	0	0	1	0	0	0	
137	Massif forestier de l'île de Basse-Terre	1	1	1	1	0	0	
138	Pointe des Châteaux	0	0	0	0	0	1	
139	Trois-Ilets & Folle Anse de Marie-Galante	0	0	0	0	1	0	
	HAITI	**2**	**5**	**5**	**13**	**0**	**5**	
140	Cavaillon	0	0	0	0	0	1	
141	Dame-Marie	0	0	0	1	0	0	
142	Dubedou	0	0	0	0	0	1	
143	Fond des Nêgres	0	0	0	0	0	1	
144	Ile de la Tortue Forest	0	0	0	1	0	0	
145	Ilet Bas limbe	0	0	1	0	0	0	
146	Lac Azuéi	0	0	1	1	0	0	
147	Lagon-aux-Boeufs	0	1	1	1	0	0	
148	**Citadelle**	0	1	0	1	0	0	Yes
149	**Plaisance**	0	0	1	1	0	0	Yes
150	**Massif de la Hotte**	1	1	0	1	0	1	
151	**Massif de la Selle**	1	1	1	1	0	1	Yes
152	**Morne Bailly**	0	0	0	1	0	0	Yes
153	Pic Tete Boeuf	0	0	0	1	0	0	
154	Presqu'ile du Nord-Ouest I	0	0	0	1	0	0	

No.	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Sea Turtles	Plants	Key Biodiversity Area within a Priority Corridor
155	Presqu'ile du Nord-Ouest II	0	0	0	1	0	0	
156	Trou Caïman	0	1	0	1	0	0	
	JAMAICA	**23**	**14**	**15**	**29**	**0**	**21**	
157	**Black River Great Morass**	0	1	1	1	0	1	Yes
158	Blue Mountains	1	1	1	1	0	1	
159	**Bluefields**	1	1	1	0	0	1	
160	**Brazilleto Mountains**	1	0	0	0	0	1	Yes
161	Bull Bay	1	0	0	1	0	1	
162	Bull Head	1	0	0	1	0	1	
163	**Catadupa**	0	1	0	1	0	1	Yes
164	Caymanas	1	0	0	1	0	0	
165	**Cockpit Country**	1	1	1	1	0	1	Yes
166	**Dolphin Head**	0	1	0	1	0	1	
167	Don Figuerero Mountains	0	0	0	1	0	1	
168	Great River	1	0	0	1	0	0	
169	**Hellshire Hills**	1	1	1	0	0	1	Yes
170	John Crow Mountains	1	1	0	1	0	1	
171	Johnson Mountain Hills	0	0	0	0	0	1	
172	Kellets Camperdown Area	1	0	0	1	0	0	
173	**Litchfield Mountain - Matheson's Run**	1	1	0	1	0	1	Yes
174	Main Ridge	1	0	0	1	0	0	
175	May Pen	1	0	0	1	0	0	
176	Milk River	0	0	1	0	0	0	Yes
177	Mocho Mountains	0	0	0	1	0	0	
178	Mount Diablo	1	1	1	1	0	1	
179	Negril	0	1	1	1	0	1	
180	North Coast Forest	1	1	1	1	0	0	Yes
181	**Peckam Woods**	0	0	0	0	0	1	
182	Point Hill	1	0	0	1	0	0	
183	**Portland Ridge and Bight**	1	1	1	1	0	1	Yes
184	Red Ground	1	0	0	1	0	0	
185	Rio Cobre	1	0	1	1	0	0	
186	Rio Grande	0	0	1	1	0	0	
187	Rio Magno	1	0	0	1	0	0	
188	Rio Pedro	1	0	0	1	0	0	

No.	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Sea Turtles	Plants	Key Biodiversity Area within a Priority Corridor
189	Santa Cruz Mountains	1	0	0	1	0	1	
190	Stephney Johns Vale	0	0	0	1	0	1	
191	Swift River	0	0	1	0	0	0	
192	Wag Water River	0	0	1	1	0	0	
193	White Rock Hill	0	0	0	0	0	1	
194	Yallahs	0	1	1	0	0	0	
	MARTINIQUE (to France)	**3**	**6**	**4**	**1**	**0**	**1**	
195	Forêts du Nord et de la Montagne Pelée	1	1	1	1	0	0	
196	Grand Macabou	0	1	0	0	0	0	
197	Ilets Boiseau et Petit Piton	0	0	1	0	0	0	
198	Mangrove de Fort de France	0	1	0	0	0	0	
199	Massif forestier entre Le Diamant et les Trois-Îlets	0	1	0	0	0	0	
200	Pitons du Carbet	1	1	1	0	0	1	
201	Presqu'île de la Caravelle	1	1	0	0	0	0	
202	Rocher du Diamant	0	0	1	0	0	0	
	MONTSERRAT (to U.K.)	**1**	**3**	**1**	**2**	**0**	**1**	
203	Centre Hills	1	1	1	1	0	1	
204	Northern Forested Ghauts	0	1	0	1	0	0	
205	South Soufriere Hills	0	1	0	0	0	0	
	NETHERLANDS ANTILLES	**1**	**4**	**3**	**0**	**0**	**1**	
206	Boven, Sint Eustatius	0	0	1	0	0	0	
207	Dos Pos, Bonaire	0	1	0	0	0	0	
208	Lac Bay, Bonaire	0	1	0	0	0	0	
209	Saba	0	0	1	0	0	1	
210	The Quill, Sint Eustatius	0	0	1	0	0	0	
211	Washikemba-Fontein-Onima, Bonaire	0	1	0	0	0	0	
212	Washington-Slagbaai National Park, Bonaire	1	1	0	0	0	0	
	PUERTO RICO (to USA)	**8**	**12**	**2**	**10**	**3**	**25**	
213	Acantilados del Noroeste	0	0	0	0	0	1	
214	Bahía de Jobos	0	0	0	1	0	0	
215	Baños de Coamo	0	1	0	0	0	1	
216	Bosque de Vega	1	0	0	0	0	1	
217	Caño Tiburones	0	1	0	0	0	1	
218	Carite	1	0	0	1	0	1	

No.	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Sea Turtles	Plants	Key Biodiversity Area within a Priority Corridor
219	Ceiba y Naguabo	0	0	0	0	1	1	
220	Ciénaga Las Cucharillas	0	1	0	0	0	1	
221	Cordillera Central	1	0	0	1	0	1	
222	Corredor Ecológico del Noreste	0	0	0	0	0	1	
223	Culebra	0	0	1	0	0	1	
224	El Yunque	1	1	0	1	0	1	
225	Guaniquilla y Boquerón	0	1	0	0	0	1	
226	Humacao	0	1	0	0	1	1	
227	Karso del Norte	1	1	0	1	0	1	
228	Karso del Sur	0	1	0	1	0	1	
229	Laguna Tortuguero	0	0	0	0	0	1	
230	Las Piedras Chiquitas	0	0	0	0	0	1	
231	Maricao y Susúa	1	1	0	1	0	1	
232	Mogotes del Norte	1	0	0	0	0	1	
233	Mona y Monito	0	1	1	1	0	1	
234	Piñones	0	0	0	0	1	1	
235	Sabana Seca	0	0	0	1	0	0	
236	Salinas de Punta Cucharas	0	0	0	0	0	1	
237	Sierra Bermeja y Laguna Cartagena	0	1	0	0	0	1	
238	Sierra de Pandura	0	0	0	1	0	0	
239	Suroeste	0	1	0	0	0	1	
240	Vieques	1	0	0	0	0	1	
	ST. BARTHELEMY (to France)	**0**	**0**	**5**	**0**	**0**	**0**	
241	Colombier	0	0	1	0	0	0	
242	Gustavio to Anse Toiny	0	0	1	0	0	0	
243	Ile Fourchue and satellites	0	0	1	0	0	0	
244	Petite Islette	0	0	1	0	0	0	
	ST. KITTS AND NEVIS	**0**	**0**	**0**	**0**	**1**	**0**	
245	Canyon to Key	0	0	0	0	1	0	
	ST. LUCIA	**0**	**5**	**3**	**0**	**0**	**1**	
246	Government Forest Reserve	0	1	0	0	0	1	
247	**Mandele Dry Forest**	0	1	1	0	0	0	
248	**North-east coast**	0	1	0	0	0	0	
249	Pitons Management Area	0	1	0	0	0	0	
250	Point Sables	0	1	1	0	0	0	

No.	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Sea Turtles	Plants	Key Biodiversity Area within a Priority Corridor
251	Rat Island	0	0	1	0	0	0	
	ST. MARTIN (to France)	**0**	**0**	**1**	**0**	**0**	**0**	
252	Tintamarre	0	0	1	0	0	0	
	ST. VINCENT AND THE GRENADINES	**0**	**7**	**7**	**7**	**0**	**0**	
253	**Colonarie Forest Reserve**	0	1	1	1	0	0	Yes
254	**Cumberland Forest Reserve**	0	1	1	1	0	0	Yes
255	**Dalaway Forest Reserve**	0	1	1	1	0	0	Yes
256	**Kingstown Forest Reserve**	0	1	1	1	0	0	Yes
257	**La Soufrière National Park**	0	1	1	1	0	0	Yes
258	**Mount Pleasant Forest Reserve**	0	1	1	1	0	0	Yes
259	**Richmond Forest Reserve**	0	1	1	1	0	0	Yes
	TURKS AND CAICOS ISLANDS (to U.K.)	**0**	**4**	**9**	**0**	**0**	**1**	
260	Bay and Middle Cays	0	0	1	0	0	0	
261	Caicos Bank Southern Cays	0	0	1	0	0	0	
262	Chalk Sound	0	0	1	0	0	0	
263	East Bay Islands	0	0	1	0	0	0	
264	East Caicos and adjacent areas	0	1	1	0	0	0	
265	Fish Ponds and Crossing Place Trail, Middle Caicos	0	1	0	0	0	0	
266	Middle Caicos Forest	0	1	0	0	0	0	
267	North, Middle and East Caicos Ramsar Site	0	1	1	0	0	1	
268	Princess Alexandra Land and Sea	0	0	1	0	0	0	
269	Salt Cay Creek and Salinas	0	0	1	0	0	0	
270	Turks Bank Seabird Cays	0	0	1	0	0	0	
	VIRGIN ISLANDS (to U.K.)	**0**	**0**	**4**	**2**	**0**	**4**	
271	Anegada: Western salt ponds and coastal areas	0	0	1	0	0	1	
272	Anegada	0	0	0	0	0	1	
273	Virgin Gorda	0	0	0	1	0	1	
274	Guana Island	0	0	1	0	0	0	
275	Little Thatch Island	0	0	1	0	0	0	
276	Necker Island	0	0	1	0	0	0	
277	Sage Mountain Area	0	0	0	1	0	0	
	VIRGIN ISLANDS (to USA)	**2**	**0**	**4**	**5**	**5**	**2**	
278	Buck Island	0	0	1	0	1	0	

No.	Key Biodiversity Area	Mammals	Birds	Reptiles	Amphibians	Sea Turtles	Plants	Key Biodiversity Area within a Priority Corridor
279	East End Bay	0	0	0	0	1	0	
280	Hassel Island	0	0	0	1	0	0	
281	Isaac's Bay	0	0	0	0	1	0	
282	Jack's Bay	0	0	0	0	1	0	
283	John Brewer's Bay	0	0	0	1	0	0	
284	Magens Bay	0	0	0	1	0	1	
285	Northwestern St. Croix	1	0	0	1	0	0	
286	Protestant Cay	0	0	1	0	0	0	
287	Ruth Cay	0	0	1	0	0	0	
288	Sandy Point National Wildlife Refuge	0	0	0	0	1	0	
289	Southgate and Green Cay	0	0	1	0	0	0	
290	St. John	1	0	0	1	0	1	

Appendix 2. Examples of Ecosystem Services and Their Contribution to Economic Development in the Caribbean Islands Hotspot (Heileman 2005)

Ecosystem	Main benefit/service
Land	- Provision of a base for agricultural and industrial activities - Reserves of oil and minerals - Food security - Property rights/land tenure - Habitat - Biodiversity
Forests/other plant species	- Promotion of infiltration of rainwater - Moderation of local climate - Promotion of rainfall - Timber products - Non-timber forest products (honey, handicraft materials, thatch, ornamental and household plants, spices, oils, medicinal plants, pharmaceutical products, seeds, tree seedlings, orchids, fruits)
Mangroves	- Export of nutrients to other ecosystems such as coral reefs and seagrass beds through tides and currents - Provision of a variety of habitats for a wide array of terrestrial and aquatic species - Provision of feeding, nursery and breeding areas for fish and other species - Fish and shellfish stocks (support artisanal fisheries) - Stabilization of coastlines, acting as a buffer between the land and the sea - Protection of adjacent coral reefs from suspended solids and drastic changes in salinity due to inflow of freshwater - Removal of contaminants from surface inflows - Nutrient retention and removal
Beaches	- Habitats and nesting sites for fauna such as sea turtles - Provision of a base for small-scale fisheries, tourism and recreational activities
Coral reefs	- Provision of a habitat for a large number of species - Provision of a hydrodynamic barrier to wave energy, thereby protecting the shoreline from erosion and facilitating the formation of sandy beaches and growth of seagrass beds - Fish and shellfish stocks (support artisanal fisheries) - Provision of sediment for the formation and maintenance of sandy beaches from the breakdown of carbonate skeleton - Ecotourism attraction - Source of seashells used in craft
Seagrass meadows	- Habitat for a variety of animals - Provision of nursery and feeding areas and shelter for fish and crustaceans - Source of detritus to reef system and nutrient cycling - Settlement and binding of suspended sediments and encouragement of accretion - Habitat for algae, including calcareous algae such as *Halimeda* sp. These algae have high concentrations of calcium carbonate and contribute to the sediment budget of beaches
Other marine systems (continental shelf, open ocean)	- Fish and shellfish stocks (support artisanal, commercial and recreational fisheries)

Appendix 3. Current Investments in Biodiversity Conservation and Climate Change Adaptation in the Caribbean Islands Hotspot

Donor	Project	Recipient	Location	Priority Key Biodivesrity Areas involved	Funds (US$x 1,000)
MULTILATERAL					
Global Environment Facility (UNDP)	Supporting Country Action on the CBD Programme of Work on Protected Areas (Early Action grant)	Gov Bahamas	Bahamas	N/A	150
Global Environment Facility (UNDP)	Establishing financially sustainable National Protected Areas System	Gov Haiti	Haiti	N/A	2,627
Global Environment Facility (UNDP)	Reengineering National Protected Areas System to achieve financial sustainability	Gov Dom Rep	Dom Rep	N/A	3,200
Global Environment Facility (UNDP)	Strengthening operational and financial sustainability of National Protected Area System	Gov Jamaica	Jamaica	N/A	2,771
Global Environment Facility (UNDP)	Community-based adaptation program	Gov Jamaica	Jamaica	N/A	(part of reg. proj.)
Global Environment Facility (UNDP)	Application of regional approach to management of marine, coastal protected areas in Southern Archipelagos (M)	Gov Cuba	Cuba	N/A	1,270
Global Environment Facility (UNDP)	Capacity building for Stage II Adaptation to Climate Change	Gov Cuba	Cuba	N/A	(part of reg. proj.)
Global Environment Facility (UNDP)	Mainstreaming and sustaining biodiversity conservation in 3 productive sectors, Sabana Camaguey ecosystem	Gov Cuba	Cuba	N/A	4,319
Global Environment Facility (UNDP)	Strengthening national system of protected areas	Gov Cuba	Cuba	N/A	2,145
Global Environment Facility (UNDP)	Enhancing prevention, control, and management of Invasive Alien Species in vulnerable ecosystems in Cuba	Gov Cuba	Cuba	N/A	5,018
Global Environment Facility (UNEP)	Mitigating Threats of Invasive Alien Species in Insular Caribbean	Gov Bah, Dom Rep, Jam, St. Luc	Bah, Dom Rep, Jam, St. Luc	Jaragua National Park (DR); Pointe Sable (St. Lucia) – demo projects	2,575
Global Environment Facility (UNEP)	Building sustainable national marine protected area network	Gov Bahamas	Bahamas	N/A	M
Global Environment Facility	OECS Protected Areas and Associated Alternative Livelihood (OPAAL)	OECS	Lesser Antilles	N/A	3,700

Global Environment Facility (WB)	Caribbean: Mainstreaming Adaptation to climate change	Governments	Insular Caribbean	N/A	5,345
Global Environment Facility (WB)	Implementation of Pilot Adaptation Measures in coastal areas of Dominica, St. Lucia, St. Vincent & Grenadines	CCCCC	Dom, St. Luc, St. Vin	N/A	1,950
Global Environment Facility (LDCF)	Strengthening adaptive capacities to address climate change and threats for coastal communities	Gov Haiti	Haiti	N/A	3,500
BILATERAL					
Darwin Initiative (U.K.)	Reducing impact of feral livestock in and around Centre Hills	RSPB	Montserrat	N/A	211
Darwin Initiative (U.K.)	Building evidence and capacity to conserve Hispaniola's endemic land mammals	Durrell Wildlife Conservation Trust	Dom Rep, Haiti	Sierra Bahoruco (DR); Massif de la Hotte (Haiti)	327
OTEP (U.K.)	Jost Van Dyke's Community-based Programme	JVD Preservation Society	BVI	Sierra Bahoruco (DR);	?
AECID/Araucaria (Spain)	Sustainable development of natural resources and community adaptation for climate change in the Jaragua-Bahoruco-Enriquillo Biosphere Reserve	Grupo Jaragua	Dom Rep	Jaragua-Bahoruco-Enriquillo Biosphere Reserve (Corridor)	230
USAID	Protected Area and Rural Enterprise (PARE)		Jamaica	N/A	1,700
U.S. Fish and Wildlife Service	Multidisciplinary, Community-based Approach to Protect Biodiversity and Bicknell's Thrush Habitat	Consorcio Ambiental Dom.	Dom Rep	Loma Guaconejo	142
U.S. Fish and Wildlife Service	Saving critical sites for Neotropical migrants in the Caribbean	BirdLife International	Bah, Bar, Haiti	Massif de la Hotte	192
U.S. Fish and Wildlife Service	Protecting Neotropical migrants from invasive species, Desecheo Island	Island Conservation	Puerto Rico	N/A	250
U.S. Fish and Wildlife Service	Migratory Bird Wintering Habitat Conservation Project Phase III	Conservation Trust of Puerto Rico	Puerto Rico	N/A	250
U.S. Fish and Wildlife Service	Sport Fish Restoration	PRDNR	Puerto Rico	N/A	2,948
U.S. Fish and Wildlife Service	Wildlife Restoration	PRDNR	Puerto Rico	N/A	1,176
U.S. Fish and Wildlife Service	Sport Fish Restoration	VIDPNR	USVI	N/A	1,810
U.S. Fish and Wildlife Service	Wildlife Restoration	VIDPNR	USVI	N/A	674

INTERNATIONAL ORGANIZATIONS / FOUNDATIONS					
MacArthur Foundation (U.S.)	Protect coastal and marine resources in Cuba	Environmental Defense Fund	Cuba	N/A	450
MacArthur Foundation (U.S.)	Training and monitoring for conservation and management of natural resources in Cuban protected areas	Cornell Lab of Ornithology	Cuba	N/A	475
MacArthur Foundation (U.S.)	Conservation of Cienaga de Zapata wetlands and building capacity for management of Cuba's protected areas system	Wildlife Conservation Society	Cuba	N/A	300
MacArthur Foundation (U.S.)	Protect coastal marine biodiversity in Monte Christi N.P	Counterpart International	Dom Rep	N/A	350
MacArthur Foundation (U.S.)	Jaragua-Bahoruco-Enriquillo Biosphere Reserve	Grupo Jaragua	Dom Rep	Jaragua-Bahoruco-Enriquillo Biosphere Reserve (Corridor)	345
MacArthur Foundation (U.S.)	Plant conservation and sustainable management in Jaragua-Bahoruco-Enriquillo Biosphere Reserve	NY Botanical Garden	Dom Rep	Jaragua-Bahoruco-Enriquillo Biosphere Reserve (Corridor)	300
MacArthur Foundation (U.S.)	Develop judicial education programs on biodiversity conservation in Hispaniola and Jamaica	Environmental Law Institute	Dom Rep, Haiti, Jam	N/A	200
MacArthur Foundation (U.S.)	Plant conservation strategy for Cockpit country of Jamaica	Fairchild Tropical Garden	Jamaica	Cockpit Country	270
MacArthur Foundation (U.S.)	Conservation of Cockpit Country and Black River Morass	Univ. of West Indies	Jamaica	Cockpit Country, Black River Great Morass	250
MacArthur Foundation (U.S.)	Economic incentives, strengthening community involvement in conservation of Cockpit Country and Martha Brae watershed	Windsor Research Centre	Jamaica	Cockpit Country	320
MacArthur Foundation (U.S.)	Build the capacity of public interest lawyers in Insular Caribbean to protect region's threatened biodiversity	Environmental Law Alliance	Insular Caribbean	N/A	300
MacArthur Foundation (U.S.)	Develop species centered approach to adaptation to climate change, insular Caribbean	WWF Canada	Insular Caribbean	N/A	250
MacArthur Foundation (U.S.)	Climate Change and Biodiversity in Caribbean	CANARI	Insular Caribbean	N/A	250
Aage V. Jensen Foundation (Denmark)	Saving the Treasures of Caribbean	BirdLife International	Bah, Dom Rep, Haiti, Jam, Cuba,	Jaragua-Bahoruco-Enriquillo Biosphere Reserve (Corridor);	408

			Puerto Rico	Massif de la Hotte; Cockpit Country	
British Birdwatching Fair (U.K.)	Eastern Cuba: saving a unique Caribbean wilderness	BirdLife International	Cuba	N/A	202
IUCN (Switzerland)	Caribbean Initiative	various	Wider Caribbean	N/A	150
Vogelbescherming Nederland (BirdLife in the Netherlands)	Building the capacity of the Dutch Caribbean Nature Alliance	DCNA	Netherlands Antilles	N/A	167
The Nature Conservancy (U.S.)	Caribbean Challenge	various	Insular Caribbean	N/A	M
World Wildlife Fund Canada	Hawksbill Haven		Cuba	N/A	400
TOTAL					53,867
TOTAL ELIGIBLE COUNTRIES					34,052

Notes:
M = primarily a marine conservation project.

Appendix 4. Biological Prioritization of Key Biodiversity Areas

Two criteria were used to assess the biological priority of a key biodiversity area: irreplaceability and species-based vulnerability. Irreplaceability is determined by the percentage of the global population of a species that is held in a site. Species-based vulnerability is based on the IUCN Red List threat status (CR, EN, VU, etc.) of a species. A matrix was created to assign priority scores to each key biodiversity area based on these two criteria.

Criteria used to assign irreplaceability scores

Irreplaceability score	"Population data" scenario	"No population data" scenario
Extreme	Sites known or inferred to hold > 95% of the global population of a species	Sites holding a species endemic to the country/region that is not known to occur at any other site
High	Sites known or inferred to hold > 10% but < 95% of the global population of a species	Sites holding a species endemic to the country/region that is only known to occur at 2–10 sites OR Sites holding a species that globally is only known to occur at 2–10 sites
Medium	Sites known or inferred to hold > 1% but < 10% of the global population of a species	Sites holding a species endemic to the country/region that is only known to occur at 11–100 sites OR Sites holding a species that globally is only known to occur at 11–100 sites
Low	Sites known or inferred to hold < 1% of the global population of a species	Sites holding a species endemic to the country/region that occurs at more than 100 sites OR Sites holding a species that globally is known to occur at more than 100 sites

Criteria used to assign species-based vulnerability scores

Species-based vulnerability score	Global threat status
Extreme	Critically Endangered (CR)
High	Endangered (EN)
Medium	Vulnerable (VU)
Low	Near Threatened (NT), Least Concern (LC)

Matrix used to assign priority scores

Irreplaceability	Species-based vulnerability	Priority level
Extreme	Extreme	1
	High	1
	Medium	2
	Low	3
High	Extreme	2
	High	2
	Medium	3
	Low	4
Medium	Extreme	3
	High	3
	Medium	4
	Low	5
Low	Extreme	4
	High	5
	Medium	5
	Low	5

Within each priority level, key biodiversity areas with more globally threatened species are prioritized over those with fewer globally threatened species. If a key biodiversity area has more than one globally threatened species, it received a plus. For example, a Priority 2 key biodiversity area with three globally threatened species will be ranked as a 2+.

Appendix 5. Priority Key Biodiversity Areas for CEPF Investment and Their Biological Priority Scores

Highest-Priority Key Biodiversity Area	Country	Biological Priority score	Corridor	Further information
Bahoruco Oriental	Dominican Republic	2		http://www.birdlife.org/datazone/site/search
Jaragua National Park	Dominican Republic	1	C	http://www.birdlife.org/datazone/site/search
Loma La Humeadora	Dominican Republic	1	C	http://www.birdlife.org/datazone/site/search
Sierra de Bahoruco	Dominican Republic	2	C	http://www.birdlife.org/datazone/site/search
Valle Nuevo	Dominican Republic	2	C	http://www.birdlife.org/datazone/site/search
Citadelle	Haiti	2	C	http://www.birdlife.org/datazone/site/search
Plaisance	Haiti	1	C	N/A
Massif de la Hotte	Haiti	1		http://www.birdlife.org/datazone/site/search
Massif de la Selle	Haiti	1	C	http://www.birdlife.org/datazone/site/search
Morne Bailly	Haiti	2	C	N/A
Catadupa	Jamaica	1	C	http://www.birdlife.org/datazone/site/search
Cockpit Country	Jamaica	1	C	http://www.birdlife.org/datazone/site/search
Dolphin Head	Jamaica	1		http://www.birdlife.org/datazone/site/search
Hellshire Hills	Jamaica	1	C	http://www.birdlife.org/datazone/site/search
Litchfield Mountain–Matheson's Run	Jamaica	1	C	http://www.birdlife.org/datazone/site/search
Peckham Woods	Jamaica	2		N/A
Portland Ridge and Bight	Jamaica	1	C	http://www.birdlife.org/datazone/site/search
Other Priority Key Biodiversity Areas				
Offshore Islands	Antigua and Barbuda	1		http://www.birdlife.org/datazone/site/search
Booby Cay	Bahamas	2		http://www.birdlife.org/datazone/site/search
Graham's Harbour	Bahamas	2		http://www.birdlife.org/datazone/site/search
Southern Great Lake	Bahamas	2		http://www.birdlife.org/datazone/site/search
Scotland District	Barbados	2		N/A
Armando Bermudez National Park	Dominican Republic	2	C	http://www.birdlife.org/datazone/site/search
Ebano Verde Scientific Reserve	Dominican Republic	2	C	http://www.birdlife.org/datazone/site/search
Enriquillo Lake	Dominican Republic	2	C	http://www.birdlife.org/datazone/sitefactsheet.php?id=19855

Haitises	Dominican Republic	1		http://www.birdlife.org/datazone/sitefactsheet.php?id=19859
Loma Guaconejo	Dominican Republic	2		http://www.birdlife.org/datazone/sitefactsheet.php?id=19860
Loma Quita Espuela	Dominican Republic	2		http://www.birdlife.org/datazone/sitefactsheet.php?id=19861
Nalga de Maco-Río Limpio	Dominican Republic	2	C	http://www.birdlife.org/datazone/site/search
PN Jose del Carmen Ramirez	Dominican Republic	2	C	N/A
Beausejour/Grenville Vale	Grenada	2		http://www.birdlife.org/datazone/sitefactsheet.php?id=19908
Mount Hartman	Grenada	2		http://www.birdlife.org/datazone/sitefactsheet.php?id=19906
Black River Great Morass	Jamaica	2		http://www.birdlife.org/datazone/site/search
Bluefields	Jamaica	1		www.birdlife.org/datazone/userfiles/file/IBAs/CaribSitePDFs/JM003.pdf
Brazilleto Mountains	Jamaica	2	C	N/A
Mandele Dry Forest	St. Lucia	2		http://www.birdlife.org/datazone/sitefactsheet.php?id=20716
North-east coast	St. Lucia	2		http://www.birdlife.org/datazone/sitefactsheet.php?id=20715
Point Sables	St. Lucia	2		http://www.birdlife.org/datazone/sitefactsheet.php?id=20714
Colonarie Forest Reserve	St. Vincent	2	C	http://www.birdlife.org/datazone/sitefactsheet.php?id=19934
Cumberland Forest Reserve	St. Vincent	2	C	http://www.birdlife.org/datazone/sitefactsheet.php?id=19928
Dalaway Forest Reserve	St. Vincent	2	C	http://www.birdlife.org/datazone/sitefactsheet.php?id=19929
Kingstown Forest Reserve	St. Vincent	2	C	http://www.birdlife.org/datazone/sitefactsheet.php?id=19932
La Soufrière National Park	St. Vincent	2	C	http://www.birdlife.org/datazone/site/search
Mount Pleasant Forest Reserve	St. Vincent	2	C	http://www.birdlife.org/datazone/sitefactsheet.php?id=19935
Richmond Forest Reserve	St. Vincent	2	C	http://www.birdlife.org/datazone/sitefactsheet.php?id=19927

Note: Biological priority was scored 1-4, with 1 being the highest priority, and 4 the lowest.

Appendix 6. Thematic Profiles of the Highest-Priority Key Biodiversity Areas in the Caribbean Islands Hotspot

		Dominican Republic					Haiti					Jamaica						
Key biodiversity area		**Bahoruco Oriental**	**Loma La Humeadora**	**PN Jaragua**	**Sierra de Bahoruco**	**Valle Nuevo**	**Les Todiers - Citadelle**	**Limbe - Plaisance**	**Massif de la Hotte**	**Massif de la Selle**	**Morne Bailly**	**Catadupa**	**Cockpit Country**	**Dolphin Head**	**Hellshire Hills**	**Litchfield-Matheson's**	**Peckham Woods**	**Portland Ridge**
Thematic factor																		
Conservation need	**Urgency of Threat**	4	3	4	4	4	3	4	4	4	3	4	4	2	4	4	2.5	4
	Existing Management Capacity	1	1	2	2	2	2	1	2	2	1	1	3	2	3	2	1	3
Provision of Ecosystem Services - *Does the KBA provide a major ecosystem service of national or hotspot-level value?*	**Food/medicine**	1	3	3	1	2	2	4	4	4	3	1	2	1	1	1	2	2
	Water	4	4	1	4	4	3	4	4	4	2	4	4	2	1	4	2	2.5
	Wood and fibre	4	4	1	4	2	1	3	4	4	3	1	2	1	1	3	1	1
	Fuel, energy	3	3	2	4	2	2	4	3	3	2	1	1	1	1	2	1	1
Regulation of Ecosystem Service - *Does the KBA provide a major ecosystem service of national or hotspot-level value?*	**Climate, microclimate**	4	4	3	4	4	2	4	4	4	2	3	4	2	2.5	3	2	2
	Disaster prevention: floods, landslide, erosion	3	3	1	4	4	2	4	4	4	3	4	4	2	2	3	2	3
	Water purification	3	3	2	4	4	2	4	4	4	2	1	1	1	2	1	1	2

		Dominican Republic					Haiti					Jamaica						
Key biodiversity area		**Bahoruco Oriental**	**Loma La Humeadora**	**PN Jaragua**	**Sierra de Bahoruco**	**Valle Nuevo**	**Les Todiers - Citadelle**	**Limbe - Plaisance**	**Massif de la Hotte**	**Massif de la Selle**	**Morne Bailly**	**Catadupa**	**Cockpit Country**	**Dolphin Head**	**Hellshire Hills**	**Litchfield-Matheson's**	**Peckham Woods**	**Portland Ridge**
Thematic factor																		
Ecosystem Service - Cultural	**Spiritual, Cultural Values**	1	1	1	1	2	4	2	4	1	2	1	4	1	1	2	1	3
	Recreation, tourism, education	2	2	3.5	3	3	3.5	2.5	4	4	2	1	3	2	2	1	1	2
Climate change adaption - Opportunities	**Adaption to sea level rise; protection of coasts**	1	1	?	1	1	1	1	1	1	1	1	1	1	2	1	1	4
	Ecosystem restoration; reforestation, carbon sequestration	2	2	1	1	1	2	4	4	4	3	3	3	2	2	4	2	3
	Habitat	2	2	1	4	3	2	4	4	4	2	3	4	3	3	3	2.5	3
	Create/ Maintain of altitudinal corridors	4	4	4	4	4	3	4	4	4	2	3	3	2	2	1	2	2
Multiplier effects	**Adjacent KBAs where conservation activities/results can be extended**	4	4	3	4	4	3	3	3	3	3	4	4	3	3	4	3	4

		Dominican Republic					Haiti					Jamaica						
Key biodiversity area		**Bahoruco Oriental**	**Loma La Humeadora**	**PN Jaragua**	**Sierra de Bahoruco**	**Valle Nuevo**	**Les Todiers - Citadelle**	**Limbe - Plaisance**	**Massif de la Hotte**	**Massif de la Selle**	**Morne Bailly**	**Catadupa**	**Cockpit Country**	**Dolphin Head**	**Hellshire Hills**	**Litchfield-Matheson's**	**Peckham Woods**	**Portland Ridge**
Thematic factor																		
	Important conservation results already obtained	3	3	4	3	4	3	2	3	3	1	1	3	2	4	1	1	3
Conditions for Success	**Existing institutional capacity**	1	1	3	2	2	3	1	3	2	1	2	3	2	2	2	1	3
	Political will by government and communities for conservation	1	1	2	2	2	3	1	3	4	1	1	3	2	1	2	1	2
Other factors	**Current Investments**	1	4 GEF $4M	3 MacA $1M	2	4 GEF $4M	1	1	4	4	1	2	3 McA $1M	2	3	2	1	3

Note: Thematic variables were scored from 1 (factor or opportunity is insignificant) to 4 (factor or opportunity if highly significant) within a national context.
GEF = Global Environment Facility; McA = MacArthur Foundation. Amounts rounded to nearest $1 million.

Appendix 7. Priority 1 Key Biodiversity Areas: Justification for Consideration as CEPF Investment Priorities

Highest priority KBAs for investment	Area (km^2)	Biological priority rating	Number of globally threatened species	Urgency of conservation action	Ecosystem service provision/regulation	Climate change adaptation opportunities	Existing investments	Opportunity for additional investment	Justification for investment/issues to address
Cockpit Country-North Coast Forest Corridor, Jamaica									
Cockpit Country	749	1	58	High	High	High	High	Medium	Critical for ecosystem services; threatened by bauxite and limestone mining; emerging co-management.
Catadupa	158	1	21	High	High	Medium	Medium	High	Critical for ecosystem services; poorly known; impacted by agriculture and illegal cutting; weak or no management.
Litchfield Mountain-Matheson's Run	158	1	44	High	High	Medium	Medium	High	Critical for ecosystem services; poorly known; impacted by agriculture and illegal cutting; weak or no management.
Portland Bight Protected Area Corridor, Jamaica									
Hellshire Hills	147	1	11	High	Low	Medium	High	High	Conservation management in its infancy; threatened by huge development pressure, forest product extraction and invasive species.
Portland Ridge and Bight	430	1	7	High	Medium	High	High	High	Conservation management is minimal; threatened by huge development pressure, forest product extraction.
Massif de la Selle – Jaragua-Bahoruco-Enriquillo Binational Corridor, Haiti and Dominican Republic									
Massif de la Selle	1,669	1	34	High	High	High	High	High	Formal park management non-existent; widespread degradation of forest and ecosystem services; large-scale reforestation needed. One of the most important key biodiversity areas for amphibians. Important watershed for water support and flood control for Port-au-Prince.
Jaragua National Park	1,694	1	15	High	Medium	Medium	High	Medium	Good management but still threatened from agriculture and tourism development (with government support).
Sierra de Bahoruco	1,152	2	33	High	High	Medium	Medium	Medium	Weak park management; illegal immigrants from Haiti; some areas still in need of protection.
Cordillera Central Corridor, Dominican Republic									
Loma La Humeadora	315	1	20	High	High	Medium	High	High	Weak park management; agricultural expansion; loss of ecosystem services.

Valle Nuevo	933	2	32	High	High	Medium	High	Medium	Weak park management; agricultural expansion; loss of ecosystem services; potential for ecotourism.
Massif du Nord Corridor, Haiti									
Plaisance	93	1	7	High	Medium	Medium	Low	High	Immense pressure from local communities; ecological integrity at risk.
Morne Bailly	21	2	6	High	Medium	Medium	Low	High	Immense pressure from local communities; ecological integrity at risk.
Citadelle	14	2	8	High	Medium	Medium	Low	High	Weak park management; immense pressure from local communities; ecological integrity at risk.
Priority key biodiversity areas outside of corridors									
Massif de la Hotte	1,287	1	42	High	High	High	High	High	Formal park management non-existent; widespread degradation of forest and ecosystem services; large-scale reforestation needed. One of the most important KBAs for amphibians. Covers three priority watersheds that serve the cities of Les Cayes, Port Salut, Tiburon and Jeremie, areas that suffer the greatest loss of life due to flooding and landslides from hurricanes and tropical storms.
Dolphin Head	168	1	22	Medium	High	Medium	Medium	High	Isolated habitat; proposed national park; impacted by illegal cutting, agriculture and invasive species.
Peckham Woods	75	2	24	Medium	Low	Medium	Low	High	Poorly known area of exceptional floristic endemism in need of attention and protection.
Bahoruco Oriental	61	2	17	High	High	Medium	Low	High	Weak park management; agricultural expansion; invasive plants and animals.

Appendix 8. Priority 2 Key Biodiversity Areas: Justification for Consideration as CEPF Investment Priorities

Key Biodiversity Area	Country	Justification
Offshore Islands	Antigua & Barbuda	Antigua has 51 offshore islands (mostly off the north-east coast). Apart from their importance for nesting sea turtles and seabirds, the islands are providing a haven for the Critically Endangered Antigua racer as a result of invasive species eradications on some islands. The eradication (and subsequent control) of invasives from additional islands in the KBA and the opportunity for hotspot-wide training make this a clear investment priority.
Booby Cay	Bahamas	Unprotected, but has been proposed as a national park to protect the endemic population of a Critically Endangered iguana. The island is impacted by invasive goats (and possibly other predators), but is poorly known biologically. Further work on the invasive species is needed along with surveys with a view to building a formal proposal for protection.
Graham's Harbour	Bahamas	Currently unprotected, but the focus of a proposal for the designation of a San Salvador National Park. If designated, the park will require a management plan and management interventions (such as invasive species eradications on the offshore islands) to protect the threatened iguanas, and nesting seabirds.
Southern Great Lake	Bahamas	Currently unprotected, but the focus of a proposal for the designation of a San Salvador National Park. If designated, the park will require a management plan and management interventions to protect the threatened reptiles and waterbirds. The potential for community co-management and ecotourism development is huge.
Scotland District	Barbados	Proposals (developed by UWI-CERMES) for the formal protection of Scotland District are in an advanced state but require investment to move them further. The area is critical for nesting sea turtles, for coastal zone protection, as one of the only areas of native woodland left on Barbados, as the site of the recent discovery of the world's smallest snake.
Armando Bermudez National Park	Domincan Republic	An important component of the Central Cordillera Corridor. Critical for biodiversity and ecosystem services (e.g. water for Santo Domingo) provision. Although well protected, with much community involvement (providing lesson learning opportunities for other key biodiversity areas in the corridor), the area is still threatened by agricultural expansion, invasive species and cutting trees for timber.
Ebano Verde Scientific Reserve	Domincan Republic	Part of the Central Cordillera Corridor and very important biuologically. Although a strict protected area, it is still threatened from timber extraction, invasive species, livestock farming, agricultural and urban expansion. The area has huge potential for eco-tourism.
Enriquillo Lake	Domincan Republic	Part of the Binational Corridor, a core zone of the Biosphere Reserve and a Ramsar site. The largest inland lake in the Caribbean with high endemism and multiple threatened species. Although "protected," the area's integrity is threatened by cattle ranching, unstainable fishing practices and inappropriate water management
Haitises	Domincan Republic	A large, diverse protected area that is ineffectively managed. Agricultural expansion (slash and burn agriculture), fragmentation, land invasion, fires are all reducing the integrity of this critical area (that includes the country's largest area of mangrove).
Loma Guaconejo	Domincan Republic	Provides an important source of water for a number of northern towns, but faces multiple threats resulting in the loss and degradation of the forest. The forest is diverse and supports multiple endemic and threatened species.

Key Biodiversity Area	Country	Justification
Loma Quita Espuela	Domincan Republic	Provides an important source of water for a number of northern towns, but faces multiple threats resulting in the loss and degradation of the forest. The forest is diverse and supports multiple endemic and threatened species.
Nalga de Maco-Río Limpio	Domincan Republic	Part of the Central Cordillera Corridor, and only part protected. Faces a multitude of threats, but ecotourism developments (e.g. the Hispaniolan Hiking Trail) provide opportunities to build a sustainable future for this and other key biodiversity areas in the corridor.
PN Jose del Carmen Ramirez	Domincan Republic	An important component of the Central Cordillera Corridor. Critical for biodiversity and ecosystem services (e.g. water for Santo Domingo) provision. The area is threatened by agricultural expansion, invasive species, cutting trees for timber. Eco-tourism developments could be developed as an integral part of a corridor conservation plan.
Beausejour/Grenville Vale	Grenada	One of the few remaining significant areas of dry forest in Grenada and in urgent need of protection. Momentum pushing for its designation (which was supported by the government) has halted as a result of the cessation of the tourist resort development at Mount Hartman.
Mount Hartman	Grenada	Currently unprotected having been degazetted as a national park, and as yet not re-gazetted to fit in with a tourist resort that is on ice due to the global economic crisis. An important area of dry forest that has been the subject of previous GEF investment, but which currently needs investment to secure its long-term future.
Black River Great Morass	Jamaica	The largest freshwater wetland on Jamaica and (in part) a Ramsar site. A management plan has been developed but never implemented. The morass faces multiple threats including hunting, invasive species, agricultural expansion; pollution; and unsustainable tourist pressure. Implementation of the management plan is urgently needed to maintain the integrity of the system.