

Antigua and Barbuda's
First National Report
to the Convention on Biological Diversity

Office of the Prime Minister
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PREFACE

Preparation of Antigua and Barbuda's first National Report to the Convention on Biological Diversity (CBD) represents an important milestone in the country's effort to achieve sustainable management of its natural resources.

This exercise is an important element of efforts to stimulate awareness, both nationally and wider afield, of the significance of the country's biological wealth and of the threats presently confronting these resources. The aim is to provide an overview of the importance of Antigua and Barbuda's biodiversity, the preservation and management efforts presently underway, and the directions sought as the country fulfills its obligations as a signatory of the CBD.

This report represents the culmination of efforts by a number of individuals and organizations. Initial work on an Inventory of biological resources was conducted by Island Resource Foundation through Dr. Bruce Horwith. An analysis of policy options for meeting the goals and objectives of the CBD was undertaken by Daven Joseph and Associates. Following this, a draft Biodiversity and Action Plan was prepared by Mrs. Cheryl Jeffrey-Appleton and Mr. McRonnie Henry. That document formed the basis for the final BSAP prepared by Mrs. Dawn Marshall. At all stages of this process, emphasis has been placed on stakeholder involvement and appreciation is extended to the participants of the various workshops and consultations held in Antigua and Barbuda prior to the preparation of the report.

Particular mention must be made of Mrs. Agnes James, Permanent Secretary in the Office of the Prime Minister, who served as overall Chairperson of the Enabling Activity Project through which the initiative was spearheaded.

Mrs. Dianne Black-Layne of the Environment Division of the Ministry of Tourism and the Environment, Mr. Lionel Michael of the Central Board of Health, and Ambassador Dr. John Ashe of the Antigua and Barbuda Mission to the United Nations were also major contributors to the elaboration of this document. Photographs were loaned by Mr. Eddison Nias, Mr. Timothy Payne of the Antigua Sun newspaper and the Environmental Awareness Group.

It is hoped that this document will be one small tool in increasing awareness at all levels of the nation's rich biodiversity and of the importance of sound environmental management in enabling a sustainable future for Antigua and Barbuda.

EXECUTIVE SUMMARY

This First National Report is submitted in compliance with the intent of Article 26 of the Convention on Biological Diversity. Its purpose is to set forth a correlation of national statement of purpose with a resulting action plan for biodiversity conservation and sustainable use in Antigua and Barbuda.

The United Nations Global Conference on the Sustainable Development of Small Island Developing States (1992) addressed the attention of the international community to the vulnerability of small-island developing states. It is now clearly recognized that the future survival of such countries is linked to the preservation and conservation of the natural environment.

Antigua and Barbuda is one of the smallest countries in the world, averaging 170 square miles in size, comprising a number of uninhabited small islands and cays, and characterized by low-lying coral and limestone formations. Climatic conditions are tropical maritime with high temperatures all year round.

A historical legacy of trade unionism and social democracy has emphasized measures for promoting economic and social development, resulting in increasing stresses on biodiversity and the natural environment. The country's economic development, however, is based chiefly upon tourism, which in turn depends heavily upon the quality of the environment. The fragility and interdependence of coastal zones and unspoiled areas therefore require careful planning and management.

The significant features of the country's biodiversity include its flora and fauna, coastal and marine resources, mangrove and wetland systems and agro-biodiversity. Both natural causes and human action have resulted in ongoing threats to the biodiversity of Antigua and Barbuda. Large areas of wildlife habitat have been erased primarily through over-exploitation of reefs, pollution, over-grazing, and the introduction of non-indigenous species. Other causes of biodiversity destruction include drought, hurricanes and overuse of pesticides.

A number of governmental and non-governmental agencies have evolved to identify, monitor and control the negative impacts of these and other threats on the nation's biodiversity. They include the Environmental Awareness Group; the Environmental Division of the Ministry of Tourism and Environment; the Development Control Authority; the Agricultural Plant Protection Unit, Forestry Department and Fisheries Division of the Ministry of Agriculture; the Central Board of Health; and the National Solid Waste Management Authority.

Given the small size of the state of Antigua and Barbuda, and the fragility of its environment, the preservation and conservation of its biodiversity is of critical importance. A Biodiversity Strategy and Action Plan has been developed to provide the framework for such action by local, national, regional and international agencies involved in promoting the goals and objectives of sustainable development in Antigua and Barbuda.

This strategy encompasses the protection of the country's biodiversity through management and conservation; the co-ordination of all activities of both governmental and non-governmental agencies; the enforcement of ecological legislation and public awareness of environmental issues. These four aspects are aimed at improving the well-being of the people, as well as the productivity and diversity of the country's ecosystem's.

A wide range of activities has been recommended in order to achieve these aims. These include:

- establishment of an integrated co-ordinating mechanism for attaining consensus and unified decisions on the implementation of the BSAP;
- inclusion of stakeholders as part of biodiversity policy planning and formulation, with emphasis on meaningful consultation and wide participation;
- support of a technically competent secretariat; and
- use of available manpower at the technical level from the public, private and NGO sectors to support the co-ordinating mechanism and the impending legal and institutional changes.

Future action will entail the evolution of actions relating to implementation of the Biodiversity Strategy and Action Plan, which provides an overall framework for controlling the dangers of invasive species, global climate change, and other continuing anthropogenic stresses on Antigua and Barbuda's fragile biodiversity resource.

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CHAPTER 1

INTRODUCTION

Antigua and Barbuda, along with much of the international community, participated in the United Nations Earth Summit in 1992 in Rio de Janeiro, Brazil. One of the principal outcomes of this exercise was the signing of the Convention on Biological Diversity (CDB) representing the first comprehensive international agreement for the protection of the Earth's biological resources.

Movement towards the CDB was spurred by increasing recognition that the Earth's biodiversity, and the ecosystems of which they form a part, are being lost at an alarming rate with negative consequences for the sustainability of critical ecosystems and the socio-economic systems dependent upon them. In many instances, recognition of the need to begin to address these problems arose from the efforts of civil society. Among the factors spurring loss of biodiversity globally are the over-exploitation of resources, pollution, climate change, and loss of important habitats.

The CDB requires that States, which are party to the agreement, develop and implement comprehensive national biodiversity strategies and action plans. At the international level, institutional structures are set up to assist countries in their implementation efforts, including a financial mechanism to provide assistance to developing countries.

The CDB seeks to tackle a major global challenge by integrating environmental conservation with economic development: the concept of "sustainable development". This approach recognizes the need for economic growth and development while requiring that economic activity proceed in a manner to allow future generations equal access to the earth's environmental resources.

Economic and social well being in Antigua are intimately linked to the preservation of the natural environment, including its biological resources. Notwithstanding these linkages, the importance of these resources, and therefore the significance of their management and conservation, have not been appreciated historically. The result has been increasing pressure on these resources. The pace of economic growth and resultant transformation of the physical landscape have exacerbated this situation in recent years. Presently, residential and tourism growth are key factors influencing land use patterns in Antigua and Barbuda. Unfortunately, this growth has taken place with little emphasis on urban planning, resulting in patterns of disorganized spatial development.

At the 1992 Earth Summit in Rio de Janeiro, Brazil, over 150 countries, including Antigua and Barbuda, signed the Convention on Biological Diversity (CBD). This Convention provides an internationally agreed upon legal framework that obliges a country to undertake measures to directly conserve and use biodiversity in a sustainable manner.

Antigua and Barbuda ratified the Convention in April, 1993. Thus it agreed to support the Convention's three basic objectives:

- Conservation of biological diversity;
- Sustainable use of its components; and
- Fair and equitable sharing of the benefits derived from the utilization of genetic resources.

The main concepts, strategies and spheres of jurisdiction for biodiversity conservation are outlined in the CDB. According to Article 6 of the Convention, each party "shall, in accordance with its particular conditions and capabilities:

- (a) Develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adopt for this purpose existing strategies, plans or programmes which shall reflect, *inter alia*, the measures set out in this Convention relevant to the Contracting Party concerned; and
- (b) Integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.

In order to assist Parties in meeting their obligations as specified by the CBD, the Global Environmental Facility (GEF) was directed to provide funds for "Biodiversity Enabling Activities". In the case of Antigua and Barbuda, this project was implemented through the Office of the Prime Minister.

CHAPTER 2

OVERVIEW OF ANTIGUA AND BARBUDA



2.1 PHYSICAL FEATURES

The archipelagic state of Antigua and Barbuda is located in the northeastern Caribbean. Antigua, 108 square miles, the larger and more populous of the islands, is located between the French department of Guadeloupe and the island of Nevis with Barbuda, 62 square miles, located some forty miles north of Antigua. Antigua and Barbuda constitutes the second smallest country in the Western Hemisphere, and one of the smallest countries in the world.

In addition to the two main islands, the State of Antigua and Barbuda comprises a number of uninhabited small islands and cays, including the island of Redonda, which has previously been known for phosphate mining and export.

Geologically, the islands of Antigua and Barbuda are distinguished from most other neighbouring islands by their low-lying coral and limestone formations. Antigua can be divided into three main regions:

- A hilly volcanic area of rugged hills in the southeast, rising to Boggy Peak (approx. 1300 ft.)
- A coastal plain of rolling lowlands
- Limestone hills and areas.

In comparison to Antigua, Barbuda's topography is relatively uniform. One distinct difference is the presence of sand dunes. The island is mostly covered with limestone and sand. Barbuda is surrounded by coral reefs. Running along the western side of the island is the largest lagoon in the Eastern Caribbean, separated from the sea by a narrow spit of land. This lagoon is of special conservation significance.

The absence of high hills and of forest growth as well as their position relative to the equatorial rain belt has meant that Antigua and Barbuda has no rivers and is frequently subject to severe droughts. Soils are generally quite fertile. The country's flat topography enables road access to virtually all areas, facilitating the fairly even distribution of settlements and industry.

Antigua's deeply indented bays and sandy beaches provide the setting for much of the island's important tourism industry. Equally, Barbuda's pink sand beaches and coral reefs provide an aesthetic and environmental feature unique to the Eastern Caribbean.

PHOTO # 1

The climate of Antigua and Barbuda is a tropical maritime one with high temperatures all year round. It is influenced by the steady easterly trade winds and has a marked dry and wet season. Daily temperatures average 75° F (24°C) in December and January and 84°F (29°C) in August and September. The impermeable nature of the soil in many areas facilitates rainfall run-off. Rainfall averages 24 - 49 inches (60 - 125 cm).

2.3 SOCIO-ECONOMIC SITUATION

The island's population consists primarily of the descendants of West Africans, brought to the New World as agricultural slave workers for the sugar cane industry, at one time the chief industry of Antigua and Barbuda.

The 1999 census has estimated Antigua and Barbuda's population at approximately 65,000 persons, and this is expanded by an annual tourist population of approximately 460,000 visitors.

PHOTOS # 2 and 3

Antigua and Barbuda's economy has since the 1960's come to rely increasingly on the tourism sector. Table I provides an indication of Gross Domestic Product in current and constant prices for 1997 and 1998.

Table I: Gross Domestic Product in Current and Constant Prices

INDUSTRY	CURRENT PRICES		CONSTANT PRICES	
	1997	1998	1997	1998
Agriculture	54.04	56.08	39.01	40.63
Mining & Quarrying	22.05	24.26	20.18	21.79
Manufacturing	29.18	31.71	27.25	28.75
Electricity & Water	41.83	42.60	38.52	38.95
Construction	146.03	166.47	132.33	145.56
Wholesale & Retail Trade	140.07	152.32	105.31	110.05
Hotels & Restaurants	175.41	171.49	160.10	156.32
Transport	170.06	176.00	132.81	134.07
Communication	104.24	113.63	102.97	112.34
Bank & Insurance	124.50	139.95	116.97	132.30
Real Estate & Housing	88.89	95.67	79.03	82.98
Government	222.47	247.09	174.64	182.99
Other Services	98.14	104.40	73.09	75.48
Less Imputed Service	101.05	116.73	102.83	120.43
TOTAL	1315.85	404.94	1099.18	1141.98
Growth Rate (%)	7.86	6.77	5.56	3.89

Table II provides tourism arrival figures by air and sea for the period 1990-1999.

Table II: Visitor Arrivals by Cruise Ship and Air (1990-1999)

YEAR	STAY-OVER AIR ARRIVALS	CRUISE SHIP PASSENGER ARRIVALS
1990	184,248	227,329
1991	182,188	254,417
1992	193,589	250,187
1993	221,230	238,473
1994	234,745	235,665
1995	191,401	227,443
1996	202,433	270,461
1997	211,444	285,489
1998	203,958	336,455
1999	207,862	328,038

Source: Annual Tourism Statistical Review (1999)

The main attractions for visitors to Antigua and Barbuda are its many white sand beaches and other aspects of its marine and coastal environment. Other sites of interest include the lookout at Shirley Heights; the bird sanctuary in Barbuda which hosts a colony of Frigate birds; Nelson's Dockyard; Betty's Hope plantation; Devil's Bridge; and the St. John's Cathedral.

Tourism facilities are scattered throughout the island but concentrations of hotels, and other tourism facilities are located along Dickenson Bay and Runaway Bay; Deep Bay/Galley Bay; Jolly Beach and English Harbour/Falmouth Harbour. Most of Antigua's hotels are located in these areas. Despite its excellent pink and white sand

PHOTOS # 4 and 5

beaches, Barbuda has not experienced the tourism development similar to Antigua, and caters primarily to an elite niche market.

However, if not properly planned and managed, tourism can significantly degrade the environment on which it is so dependent. The fragility and interdependence of coastal zones and unspoiled areas therefore require careful planning and management.

Agriculture, which formerly dominated the country's economy through the sugar industry, now provides a relatively minor direct contribution mainly through the fisheries sub-sector, including the export of lobsters from Barbuda. Agricultural production includes fruits, vegetables and livestock. Government's policy aims to modernize farming techniques; encourage export promotion and import substitution; and, through effective linkages with the tourism industry, reduce the leakage of foreign exchange earnings.

Abandonment of sugar lands has been an unplanned spur to residential and commercial development on to former agricultural lands. In recent years, the construction and offshore financial sectors have also served as important stimuli to the economy.

In addition to the directly productive sectors, government services provide a major element of the national economy through provision of public services and constituting the largest single employer. Other sectors playing significant roles include retail trades, transport and communications.

Institutionally, the country has inherited administrative structures patterned on the Westminster political and constitutional model. While possessing certain strengths, the emphasis on vertical administrative structures tends to reduce the ability for effective inter-sectoral and inter-agency collaboration and coordination of resources. This is particularly important for biodiversity management based on an ecosystem approach as promoted in the CDB because of the number of multiple use and user conflicts issues likely to arise where management is required to encompass the variety of socio-economic actors involved.

The country's political culture has in large part reflected the transition from an agricultural economy based on cheap peasant labour to a tourism-based economy with a relatively advanced standard of living. Critical to this has been the historical legacy of trade unionism and social democracy, which has emphasized measures for promoting economic and social development, including the use of economic and fiscal incentives. One unfortunate consequence of such economic growth has been the increasing stresses on biodiversity and the natural environment.

The rich historical and cultural heritage of Antigua and Barbuda is soundly reflected in the remaining historical sites which can still be found throughout the country.

Table III: Historical and Cultural Heritage Sites.

Type of Site	Number	Location
Pre-Colombian Sites	199	Antigua
Pre-Colombian site	18	Barbuda
Shipwreck sites	127	Antigua
Shipwreck sites	146	Barbuda
Historical and Natural History Sites	321	Antigua
Historical and Natural History Sites	15	Barbuda

PHOTO # 6

CHAPTER 3

BIODIVERSITY OF

ANTIGUA AND BARBUDA

3.1 INTRODUCTION

Biodiversity is important to Antigua and Barbuda both for the direct and indirect uses of its components. Given the small size and density of human settlement, as well as the generally fragile environment of small island states, the ecological functions and physical processes related to biodiversity are extremely important. In particular, the country's economic development, based chiefly upon tourism, is highly dependent upon the quality of its environment, which in turn is influenced significantly by those same ecological functions and physical processes related to its biodiversity.

These processes include the creation and preservation of soils, the storage and distribution of water, and the regulation of coastal and atmospheric conditions. In addition, there are the direct and indirect uses of biodiversity as important genetic resources, food (wild fruits, agricultural products, fish, etc.) and local medicines. Extensive grass and scrublands support livestock production. Other benefits include those of an educational, recreational and aesthetic nature.

3.2 MAIN FEATURES

3.2.1 FLORA

The natural indigenous vegetation of Antigua was virtually decimated during the sugar production years (1660 - 1960). The result is that the majority of Antigua's existing land cover is made of secondary growth with a few areas of original vegetation cover. Barbuda, on the other hand retains much of its original forest and is primarily covered by evergreen bush land - a mixture of white cedar, loblolly, cinnamon, bearded fig and shrub species.

Of the 54 vegetation communities identified for the country, 16 are listed as **rare**, 26 as **uncommon**, and 12 as **common**. Those communities listed as being **rare** must be considered endangered or vulnerable.

The documented flora comprise:

- 1158 species (149 families) of plants
- 45 species of ferns and fern allies (5 families)
- 4 species of gymnosperms (3 families)
- 1109 species of angiosperms (141 families).

It is documented that there are some 197 species of flowering plants that are considered to merit special conservation concern. These include 22 species identified as endemic to the Lesser Antilles (one of which, *Pectis ericifolia*, may be endemic to Barbuda). An additional 73 species are classified as rare, including several that are believed to have become extirpated.

PHOTOS # 7 and 18

3.2.2 FAUNA

The freshwater fish fauna of Antigua and Barbuda has not been well studied, and consequently little is known about it. Several of the species that exist are known to have been deliberately introduced for aquaculture, while several others appear to be aquaria fish that have been naturalized in ponds and waterways after being discarded.

A list of marine fish that occur specifically in the waters of Antigua and Barbuda does not exist, but for comparative purposes, there are some 400 species included in Caribbean fish guides. Data on the status of any marine fish species occurring in national waters is sparse and lacks a baseline to suggest trends.

There are two species of amphibians known:

Tree Frog (*Eleutherodactylus johnstonei*)

Formerly a Lesser Antillean endemic, now introduced and naturalized in Jamaica, Bermuda and parts of northern South America.

Marine Toad (*Bufo marinus*)

An introduced species, widespread in the Caribbean.

PHOTO # 8

Twenty terrestrial reptile species or sub-species have been recorded, 4 of which are extinct mainly due to the introduction of the Indian Mongoose during the plantation era:

Red-footed Tortoise

(*Geochelone carbonaria*)

Still fairly common.

Gecko

Three species recorded.

Anolis Lizard

Three species common.

Ground Lizard (endemic)

Common in Barbuda.

Racer Snake (*Alsophis antiguae*)

Only exists on Great Bird Island. Focus of a continuing conservation programme.

The only marine reptiles known to nest in Antigua and Barbuda are three species of endangered sea turtle:

Hawksbill (*Eretmochelys imbricata*)

Most common. 400-500 nests annually.

Green Turtle (*Chelonia mydas*)

Population has declined dramatically.

Leatherback (*Dermochelys coriacea*)

Seasonal visitors. These rarely nest.

Turtles nesting sites can be found on several of Antigua's beaches, including Jabberwock, Pearns, Rendezvous Bay, Turtle Bay and Devil's Bridge. In addition, the North Sound Islands of Green Island, Goat Island and Sandy Island and Long Bay in Antigua and Welcher Bay in Barbuda have turtle nesting sites. A turtle conservation and monitoring project is being carried out on Long Island. Other living/breeding species are not under observation and nesting females and hatchling turtles are threatened by coastal development.

Approximately 182 species of birds have been recorded for Antigua and Barbuda. About two-thirds are migratory; one-third represents year-round residents. Twenty of the approximately 60 residents are considered endemic to the West Indies sub-region, and in some cases, are restricted to the Lesser Antilles.

Barbuda's Codrington lagoon is home to one of the most important nesting colonies of magnificent Frigate birds in the Caribbean. The Frigate bird colony has become a key research station for studying the habits of this species.

PHOTOS # 9, 10 and 11

The islands of the Eastern Caribbean serve as an important link in the seasonal migration of numerous birds. Several two-three year periods of severe drought over the past two decades are assumed to have impacted bird populations; as have the almost annual hurricanes that have hit the country since 1995. Drastic reductions in the populations of small songbird species have been noted.

Bats are the only native terrestrial mammals in the country. Seven species have been found on both islands. These include the:

Common Fruit Bat (*Artibeus jamaicensis*)

Pig-faced or Rat Bat (*Brachyphylla cavernarum*)

Long-tongued Fruit Bat (*Monophyllus plethodon*)

Fishing Bat (*Noctillo leporinus*)

Funnel-eared or Long-legged Bat (*Natalus stramineus*)

Brazilian Free-tailed Bat (*Tadarida brasiliensis*)

Velvety House Bat (*Molossus molossus*).

Mammals brought to Antigua and Barbuda include:

Agouti (*Dasyprocta agouti*)

Extinct

Fallow Deer (<i>Dama dama dama</i>)	Introduced for game.
Indian mongoose (<i>Herpestes javanicus</i>)	Introduced to control vermin in the plantation.
Rat (<i>Rattus rattus/Rattus norvegicus</i>)	
Mouse (<i>Mus muscalus</i>)	Inadvertent introductions.

There are 26 species of marine mammals recorded for the Caribbean, 7 of which have been recorded for Antigua and Barbuda. It is likely that several other species also use these waters during migrations. The following have been sighted from specific locations:

Humpback whales
Pilot whales
Minke whales
Sperm whales
Bottlenose dolphins
Atlantic spotted dolphins

Very little information on invertebrates exists for Antigua and Barbuda, or the Lesser Antillean sub-region as a whole. Among the more popular species are:

Beetle (*Coleoptera*)
Sponges (*Parifera*)
Corals, jellyfish, anemones (*Cnidaria*)
Flatworms (*Platyhelminthes*)
Worms (*Annelida*)
Spiders, mites, ticks (*Arachnida*)
Centipedes (*Chilopada*)
Dragonflies (*Odonata*)
Grasshoppers, crickets (*Orthoptera*)
Ants, bees, wasps (*Hymenoptera*)
Flies, mosquitoes (*Diptera*)
Butterflies, moths (*Lepidoptera*)
Lobster, shrimp, crab (*Crustacea*)
Shell creatures (*Mollusca*)
Starfish, sea urchins, sea cucumbers (*Echinodermata*).

Despite the inadequate research, the major conservation threat has been identified as loss of habitat, which results in the gradual loss of the numerous species of invertebrate animals found within each of the islands' vegetation communities.

3.2.3 COASTAL AND MARINE RESOURCES

The coastal and marine resources in Antigua and Barbuda contain some of the most diverse and productive habitats. These include extensive areas of complex specialized ecosystems, such as mangroves, coral reefs and sea grass beds: systems which are highly sensitive to all types and sources of pollution. The ecosystems are the source of a significant proportion of food production and support a variety of economic activities including fisheries, tourism, recreation and transportation.

Sea grass beds, though important, are little researched and underestimated. They provide habitat for two priority marine animal taxa – turtles and conch.

Antigua and Barbuda has approximately 25.45 sq. km. of reef coverage. The reefs are better developed on the windward side of the islands, where the high wave energy provides circulation of nutrients, flushing action and there is an absence of fine, muddy sediments.

Coral reef ecosystems consist of the reefs and the associated flora and fauna. They are used by island communities on a subsistence and commercial level. The shift and focus to a tourist-based economy in Antigua and Barbuda has increased the significance of these marine resources.

PHOTO # 12

There are four main types of coral reefs found around Antigua and Barbuda - **Barrier, Bank Barrier, Patch and Fringing Reefs.**

The Barrier Reefs lie near the southern shore and parallel a steep slope at the edge of the narrow shelf. The Bank Barrier reefs are the predominant large reefs off Antigua. They can be found particularly on the northeastern and southwestern flanks. Patch reefs are found mainly in Barbuda and are built up from the lagoon floors by successive accretion from depths of as much as 20m. The fringing reefs are found in both Antigua and Barbuda. This type of reef face channels with vigorous surf or currents that provide nutrients and clear water.

Various species of fish are indigenous to the reefs of Antigua and Barbuda. Commercially valuable pelagic species which inhabit Antigua and Barbuda waters include **snapper, tuna and billfish.** The **spiny lobster (Panulirus Argus)** inhabits rock, hard sand, and coral bottoms close to reefs and headlands. The **queen conch** is another species considered as a valuable resource. Like lobster, conch is being heavily exploited.

In addition to being a major fisheries resource, coral reefs provide protection to the shoreline and sediments for beaches.

Coral reefs are also under stress from natural processes - mainly hurricanes. Hurricane Hugo (1989) significantly impacted the coral reefs of Antigua and Barbuda. Hurricanes have also inflicted serious damage to the southern and southeastern reefs, but signs of recovery are evident. Hurricane Luis (September 1995), followed by Marilyn two weeks later, caused additional stress to the country's reefs.

In addition to the impacts/effects of natural disasters, other natural threats to coral reefs are significant. Predation by other organisms and cannibalism by other corals, crowding and substrate take-over by various algae, bleaching, land-base source of marine pollution to include pesticide run off and sewage are significant threats to our coral reef.

The reef fish population has decreased significantly over recent years. This is because of the impacts/threat of natural disasters as well of over-fishing. Over-fishing has caused a significant decline in the fish population and the continued removal of excessive numbers of fishes from the reef may have long lasting deleterious effects on all aspects of reef ecology.

PHOTO # 13

3.2.4 MANGROVE AND WETLAND SYSTEMS

Thirty-six mangrove sites are known to exist, ranging from small, single-species, single-layer stands of trees to larger complex systems. The mangroves of Barbuda are known to be important for their variety of aquatic life and avifauna.

The dominant species on both islands are:

Red Mangrove (<i>Rhizophora mangle</i>)	Dominant
Black Mangrove (<i>Avicennia nitida</i>)	Common
White Mangrove (<i>Laguncularia racemosa</i>)	Common
Button Mangrove (<i>Conorcarpus</i>)	Occasional.

Rhizophora, known as “the plant that makes land”, is the most typically recognized species. It grows at the water’s edge, and new seedlings become established seaward. Besides providing support and hiding places for a wide variety of marine animals, the prop roots system of the plants traps sediments that accumulate from the plants or are washed down from the land.

The mangroves function as nursery, breeding ground, and habitat for both marine and terrestrial wildlife. They are also used for recreation and charcoal production.

3.2.5 AGRO-BIODIVERSITY

Conservation of agro-biodiversity is critical both at national and global levels. Current agricultural productivity, as well as long-term viability, depend on genetic variability within crop plants and domesticated livestock. Many farmers have abandoned traditional crop varieties in favour of a few new “high-yielding” strains. In addition, wild relatives of these species are being lost as natural habitat is converted for other land uses. The genes of wild relatives and old strains of domesticated species will be needed in the future in order to develop the qualities and characteristics that can help cultivated species withstand new pests and disease outbreaks, and adapt to environmental changes and other challenges that might lie ahead.

Table IV shows the most important crops /livestock for which there are one or more local varieties in the Antigua and Barbuda:

Table IV: Crops/Livestock for which there are One or More Local Varieties

<i>Eggplant</i>	<i>Table squash</i>	<i>Corn</i>
<i>Hot peppers</i>	<i>Pumpkin</i>	<i>Barbuda lima bean</i>
<i>Cowpea</i>	<i>Gourd</i>	<i>Sea island cotton</i>
<i>Pineapple</i>	<i>“Cruffy” cucumber</i>	<i>Redonda goat</i>

Source: Antigua and Barbuda Stocktaking and Inventory of Existing Information (1999)

The Department of Agriculture considers the survey and documentation of all traditional crop and livestock varieties a priority, along with improving and expanding of seed storage facilities. However, limited financial resources are a constraint in implementing these priorities.

Several significant gaps have been identified with respect to the importation and use of agricultural chemicals. These gaps include lack of registration of pesticides and formal data on importation and use. It is believed that the number of different kinds of pesticides and the amount of pesticides continue to increase.

PHOTO # 19

3.3 THREATS TO BIODIVERSITY

Antigua and Barbuda, like any other small island state, is renowned for its diverse species of flora and fauna. However, due to the small size, isolation and fragility of the island's ecosystems, its biological diversity is among the most threatened in the world. Deforestation, coral reef deterioration, habitat degradation and loss, and the introduction of certain non-indigenous species are the most significant causes of loss of biodiversity.

The majority of these threats result from changes brought about by human action, while others result from natural causes. Some of the more significant threats are listed below:

The loss of habitat constitutes one of the greatest threats to biodiversity in Antigua and Barbuda. Habitat is lost primarily through the sub-division of lands for housing, tourism development, agriculture, and the mining and dredging of sand. The loss of nesting habitat is considered to be the greatest threat to the three species of endangered sea turtles that are known to nest in Antigua and Barbuda. Significant areas of wildlife habitat in both terrestrial and marine ecosystems have been eliminated to accommodate development. In recent years, the development of the tourism industry

has been facilitated by clearing natural vegetation and altering beaches, while coral reefs have been damaged by divers and boat operators.

Mangrove species, cactus species, littoral woodland species such as sea side grape, manchineel, deciduous species such as turpentine, white cedar and evergreen species such as Spanish oak and Antigua Whitewood are being destroyed and therefore need to be protected.

The introduction of non-indigenous species to an area has had a detrimental effect on native wild species. These invasive species act as predators, parasites or competitors, resulting in declines of native species. The Indian mongoose (*Herpestes javanicus*), an introduced species, is largely believed to be responsible for the expiration of the harmless endemic Racer snake (*Alsophis antiguae*) from the mainland of Antigua, as well as a reduction in numbers, as well as changes in the behaviour, of several native bird species. In addition, hunting - which is partially regulated by license and limits of kill - is a constant and increasing threat to animal life.

Similarly, the rapid spread of lemon grass (*Cymbopogon citratus*), also introduced, represents a significant alteration to the natural habitat, and a serious threat to native forests. The problem lies not only with the grass itself, but the grass in combination with the cultural practice of setting the grass alight at the beginning of the dry season. The grass is adapted to fire, which creates the condition of destroying the peripheral vegetation and therefore the site for seed germination and the subsequent growth and expansion of the grass.

Overgrazing by livestock (mainly goats, sheep, cattle and donkeys) poses a serious threat to the biodiversity of the country, particularly in the upper watershed areas.

Pollution poses a serious threat to the marine environment mainly as a result of excessive nutrients or sewage discharge into coastal waters; this could alter the species composition both in the water column and in benthic communities, which may lead to local changes in biodiversity. Even more serious is the severe effect of low oxygen concentrations, which can lead to mass mortalities. Also linked to eutrophication is harmful algal bloom. Ciguatera, a disease affecting the nervous and cardiovascular systems, is caused by eating tropical fish that have bio-accumulated toxins from natural algae. Where algal biomasses are significantly elevated, such as in nutrient/sewage-enriched areas, the risk of ciguatera is high. Nutrient abatement is recommended where eutrophication symptoms occur.

Droughts and hurricanes have severely impacted the bird population, as well as vegetative communities and their dependent fauna. Unregulated and excessive use of pesticides and hunting have also reduced the population of birds.

Coral reefs become stressed as a result of both natural and anthropogenic activities. Stresses occur as a result of high sedimentation, increase nutrient loading, direct destruction and over-exploitation of the reef. High nutrients/sediments levels can smother corals or encourage the growth of green algae, which prevents light reaching the reef and can kill both coral and algae.

Over-fishing, and hence over-exploitation of reefs, is rapidly occurring. One effect of over-exploitation is that it can result in the take-over by green algae as a result of the reduction of population of algal-feeding fish.

Direct destruction of reefs occurs due to the improper placement of fish traps, boat and anchor damage and offshore dredging. Recreational diving and marine resource extraction is also having adverse impact on reefs.

CHAPTER 4

BIODIVERSITY ACTIVITIES BEING UNDERTAKEN

4.1 PROTECTED AREAS

A number of areas of outstanding natural resource, aesthetic and cultural significance, have been designated to various levels of protected status. These include:

Wallings Conservation Area

This area has long been recognized as one of the premier destinations for residents and visitors alike to view and experience the forests that once covered much of Antigua. Its rich biota includes a diverse flora, magnificent old specimen trees, and numerous songbirds. The Forestry Department has been working for several years to protect these resources, develop a trail system and institute a management programme for the area, which is one of the primary terrestrial eco-tourism sites in the country.

PHOTO # 14

PHOTO # 15

The Offshore Islands of the North Sound

Great Bird Island and some of the islands of the North Sound are critical to the survival of the endemic Racer snake and several species of seabirds, as well as numerous species of plants. They contain some of the country's best examples of dry forest and other native vegetation. The offshore islands can be valuable conservation tools as refuges, and as outdoor laboratories and classrooms for teaching, training and educating the public on environmental issues. One island, Guiana Island, is the site of an innovative Turtle Monitoring Programme which highlights the linkages between tourism and nature conservation.

Codrington Lagoon, Barbuda

The Codrington Lagoon is probably the most outstanding and significant component of Barbuda's coastal zones, taking up virtually the entire western coastline. It is about seven and a half miles long and two and a half miles at its widest point, and is entirely enclosed except for a narrow channel at

the northern end. The lagoon and its associated mangroves and pink-sand beaches represent a natural resource unparalleled in their beauty and importance to the economy. It is also a productive fishing area that plays an even more important role as a nursery for juvenile lobsters and other marine resources. The northern section consists of one of the most extensive stands of mangroves in the country, and provides nesting habitat for the largest colony of magnificent frigate birds in the Caribbean – perhaps in the world.

PHOTO # 16

Nelson's Dockyard National Park

This area incorporates some of the country's best-preserved historical and archaeological sites, as well as areas of ecological significance. The Park represents the only legally designated National Park and is managed primarily for its tourism attractions, which include the historic Nelson's Dockyard. The site is a multiple-use area with controlled residential, tourism and agricultural activities within its jurisdiction.

4.2 ENVIRONMENTAL AWARENESS GROUP

The Environmental Awareness Group (EAG) is Antigua's principal non-governmental environmental organization. Started in the early nineties, it focused initially on public awareness issues. As environmental problems increased and became more complex, the EAG has shifted its focus and broadened its functions. These functions now include pollution prevention, education and public awareness, and providing advocacy information for the media. Ongoing projects include:

- Information gathering for the Wetlands Conservation Project
- Coral Reef Education Project
- Environmental Education Programme
- Forestry Conservation
- Antigua Racer Snake Conservation Project
- Field Trips
- Education of School and Youth Organizations.

The EAG's role in promoting public awareness of environmental concerns has been particularly significant, and the organization continues to collaborate with a large number of governmental and non-governmental partners in this regard. One notable feature has been its initiation of a programme of national environmental awards.

4.3 ENVIRONMENTAL DIVISION, MINISTRY OF TOURISM AND ENVIRONMENT

The Environmental Division in the Ministry of Tourism and Environment is the agency charged with the executive responsibility of managing and administering various aspects of the nation's physical, biological and cultural environment. Its functions cover a wide range of environmental issues and concerns, including:

1. Development and implementation of projects related to the rehabilitation and protection of the environment.
2. Co-ordination of the development of environmental legislation in all areas of environmental management.
3. Development and implementation of a natural environmental awareness programme, including the introduction of environmental education into the school curriculum.
4. Design and implementation of a programme to enhance beaches and coastal areas.

5. Production of a biannual report providing comprehensive information on the health of the environment.
6. Identification and co-ordination of the implementation of Antigua and Barbuda's commitments to international environmental agreements. This includes the co-ordination of the implementation of the recommendations of the National Co-ordinating Mechanism.
7. Production of a comprehensive natural resource map which identifies major areas of importance to the health of the environment, including watersheds, coral reefs, mangroves, forests and protected areas. This map may be used for natural resource management, physical planning and tax collection purposes.
8. Development and implementation of a national beautification programme.
9. Provision of advice on environmental issues to government agencies and the general public.
10. Co-ordination of the process of conducting environmental impacts assessment for major developmental projects.

4.4 DEVELOPMENT CONTROL AUTHORITY

The Land Development and Control Act of 1974 created and established the Development Control Authority (DCA) with responsibility for Land Use Planning and Development Control. The DCA also has responsibility for conducting land use and socio-economic surveys of Antigua and Barbuda and determining developmental impacts, as well as for maintaining information on land development issues.

The DCA has recently completed a National Physical Development Plan for Antigua and Barbuda. In relation to Biodiversity, the land use policies articulated in this plan seek to:

1. Protect the natural flora and fauna to maintain the integrity of terrestrial ecosystems while preventing further environmental degradation.
2. Protect and enhance the quality of the natural environment by minimizing levels of air, land and water pollution.
3. Protect and promote the sustainable use of the country's forest resources.
4. Preserve and rehabilitate coastal and marine resources to meet the needs of the fishing and tourism industries and to manage the development of these resources so as to protect coastal ecosystems and prevent degradation of the marine environment.
5. Conserve sites and/or buildings of ecological, scenic, historical, architectural and archeological significance.

6. Establish a balanced hierarchy of settlements, adequately serviced with an appropriate level of physical and social infrastructure.
7. Conserve and allocate quality agricultural land and water resources so as to minimize the loss of agricultural land to build development and to facilitate sustainable and productive agricultural development.
8. Facilitate the exploitation and allocation of natural and man-made resources to meet the needs of the tourism industry and other legitimate users, within the context of sound environmental and resource management practices.

The DCA 's function as the technical agency charged with monitoring and advising on physical development means that this agency plays a crucial role in efforts at promoting sustainable use and conservation of the nation's biodiversity.

4.5 AGRICULTURAL PLANT PROTECTION UNIT, MINISTRY OF AGRICULTURE

In relation to the conservation and protection of the nation's biodiversity, the Plant Protection Unit is responsible for the exclusion and prevention of entry of exotic pests and disease into the country by inspection of imported unprocessed plant material; sanitary confiscation of prohibited or diseased plant produce or material; and control of imports and exports by the issuance of important licences and phytosanitary certificates, respectively.

The Unit is also responsible for the continuous surveillance of plants island-wide (particularly high risk areas such as plant nurseries, major farming areas, hotels and government agricultural stations) for suspicious or inordinately high levels of pests and disease.

All ports of entry into Antigua and Barbuda are also monitored. Two crops which are especially monitored are the Sea Island Cotton and the Antigua Black Pineapple.

By executing these activities on a regular basis, the Plant Protection Unit aims at intercepting and/or containing pests and diseases before they have a chance to establish themselves and become damaging to the nation's flora and fauna, including its indigenous species.

4.6 FORESTRY DEPARTMENT, MINISTRY OF AGRICULTURE

The Forestry Department of the Ministry of Agriculture promotes the management and protection of the nation's forest resources. This includes functions relating to the protection of watersheds, enforcement of forestry legislation, and promoting awareness of the importance of the country's forestry. The department is also responsible for the management of the Wallings Forest Reserve, one of the nation's principal tourism assets. Plans underway call for the protection and sustainable management of the country's south-western forested areas through an integrated forestry and coastal resource management regime. Urban forestry is also foreseen as an area for future attention.

Problems presently confronting the Forestry Department include inadequacies in legislation and administrative arrangements as well as budgetary and other financial resource restraints.

4.7 FISHERIES DIVISION, MINISTRY OF AGRICULTURE

In Antigua and Barbuda the Fisheries Division of the Ministry of Agriculture performs a number of vital services in relation to Biodiversity. First and foremost, as the agency responsible for overseeing the nation's fisheries resources, the Department aims to ensure that yields are sustainable and that over-exploitation does not take place.

The Fisheries Division oversees a statistical and information-gathering network aimed at providing resource managers with information as to the type and quantity of fish harvested. This allows monitoring of population trends and provides a basis for management decisions. The Department is also extremely active in programmes to promote sustainable utilization of the natural resources that provide the habitat for fishing resources including mangroves, coral reefs, and sea-grass beds. There is current involvement in a regional programme aimed at inventorying the nation's coastal and marine resources – living and non-living – and their uses and stresses. This information is being used to provide planners with up-to-date information on changes taking place in the coastal and marine environment.

The Fisheries Division has also been involved in an ongoing programme of monitoring sea-level rise at various stations, as well as co-ordination activities relating to assessing the impact of climate change on the nation's coastal and marine environment.

4.8 CENTRAL BOARD OF HEALTH

The Central Board of Health in the Ministry of Health is the agency responsible for environmental health and general sanitation, and has several functions as it relates to the Biodiversity of Antigua and Barbuda. These include the monitoring of drinking water supplies (surface and ground water), monitoring of marine and coastal waters, liquid waste management. The agency also investigates environmental health emergencies and participates in helping Antigua and Barbuda meet its international obligation in relation to conventions and treaties.

The Central Board of Health is also responsible for co-ordinating efforts concerning bio-safety and has played a lead role in developing national technical mechanisms on bio-safety and promoting awareness of the benefits and threats associated with these technologies.

4.9 NATIONAL SOLID WASTE MANAGEMENT AUTHORITY

The National Solid Waste Management Authority is responsible for solid waste management – storage, collection, treatment and disposal of solid waste. Its functions contribute to the protection of the Biodiversity of Antigua and Barbuda by ensuring that solid waste is managed in an environmentally sound manner. The Authority is presently working towards the establishment of a sanitary landfill site. This will have significant benefits for the health of the nation's wetlands and coastal areas.

CHAPTER 5

BIODIVERSITY STRATEGY AND ACTION PLAN

5.1 INTRODUCTION

With support from the Global Environment Fund and the United Nations Development Programme (UNDP), the Government of Antigua and Barbuda has embarked on a programme to meet the requirements of the CBD through the development of a Biodiversity Strategy and Action Plan (BSAP).

The BSAP has been developed following a broad-based consultative process involving a wide range of stakeholders from governmental and non-governmental agencies and organizations. It is intended to provide the framework for action by local, national, regional and international agencies involved in promoting the goals and objectives of sustainable development in Antigua and Barbuda. The BSAP is also consistent with the goals and objectives of efforts by the country in relation to combating land degradation under the Desertification Convention and to promote sustainable development under the Framework Convention on Climate Change.

5.2 THE STRATEGY

The strategy envisaged for the BSAP is a four-pronged one encompassing:

- i) The sustainable use, protection and conservation of Antigua and Barbuda's biodiversity;
- ii) The co-ordination of efforts and activities involving the sustainable use, protection and conservation of biodiversity;
- iii) The enforcement of policies, regulations and legislation affecting these efforts and activities; and
- iv) Improved knowledge and understanding of the processes governing biodiversity so as to guide and co-ordinate the activities involving the sustainable use, protection and conservation of biodiversity.

Together these four aspects of the strategy address the obstacles to biodiversity planning including institutional, scientific and legal obstacles. They are aimed at improving and maintaining the well-being of the people of Antigua and Barbuda, as well as the productivity and diversity of the country's ecosystems. In fulfilling this aim, they cover the full scope of the CBD.

The overall aim of the BSAP is that:

The biological diversity of Antigua and Barbuda is sustainably and equitably used, protected and conserved so that it contributes positively to the social and economic development of the country.

Arising out of this goal is a number of objectives linked to the various provisions of the CBD:

OBJECTIVE 1: A national system, including protected areas, for the management and conservation of biodiversity should be established and developed.

OBJECTIVE 2: The capacity of governmental natural resources management institutions, as well as non-governmental organizations, to support the objectives and achieve the overall aim of the BSAP, should be strengthened.

OBJECTIVE 3: Ecological legislation that provides adequate protection of biological diversity should be improved, enacted and enforced.

OBJECTIVE 4: Public awareness of environmental issues, ecological education and public participation in decision-making should be improved.

5.3 ACTIVITIES REQUIRED TO ACHIEVE THE OBJECTIVES:

The BSAP requires that there is a wide range of activities required to achieve these objectives. These include:

- 1. Identifying critical habitats and species (terrestrial and marine) for conservation in Antigua and Barbuda.**

This should include a review of available information to identify the individual species, habitats and ecosystems that are most vulnerable to human disturbance and develop recommendations for their protection, both within and outside protected areas.

- 2. Developing recommendations for the sustainable use of the individual species, habitats and ecosystems.**
- 3. The developing and implementation of plans for the development of eco-tourism.**
- 4. Developing and implementing management plans for protected areas (terrestrial and marine)** by developing guidelines for the management of protected areas with emphasis on the protection and sustainable use of biological resources.

5. Establishing an Integrated Pest Management Programme.

This should include regulation of the use of pesticides and herbicides in order to minimize environmental pollution. Measures should be adopted to prevent over-fishing, including a ban on destructive fishing gear and spear-gun fishing.

6. Conserving medicinal plants.

An investigation should be undertaken into the occurrence and use of local medicinal plants, including the potential for bio-prospecting. The recording of such uses should be improved and catalogued, making the information more readily available to the general public.

7. Maintaining viable populations of local crop and livestock races.

All traditional crop and livestock varieties need to be surveyed and documented. The infrastructure and technical and managerial base for a seed bank or similar mechanism needs to be developed. These materials should be collected from specified crops.

It is recommended that a gene bank or banks should be established as security against disasters, extinction, etc., as well as for museum collections. Tissue culture should be encouraged. Intellectual property rights should also be established e.g. for the Antigua Black pineapple.

The role of plant nurseries needs to be strengthened, in particular forest and agricultural nurseries, for the propagation of and research on required planting stock – improving existing facilities where appropriate.

8. Developing and implementing guidelines for controlling access to

genetic resources.

A regional approach to controlling access to genetic resources should be promoted to the greatest extent possible. Appropriate policies, laws and enforcement mechanisms, and the institutional framework necessary to regulate access to genetic resources will need to be developed based on the Cartagena Biosafety Protocol.

9. Establishing the necessary policy, legal and institutional framework that would facilitate the management, sustainable use, and protection of the country's biodiversity.

10. Providing direct incentives to promote positive biodiversity conservation.

Incentives to promote the conservation and sustainable use of biodiversity need to be developed. These should be aimed at reducing dependence on traditional command and control measures.

11. Developing the legal framework to ensure the safety of biotechnology, as well as to ensure that maximum benefits accrue to Antigua and Barbuda from the exploitation of its biological resources.

Policies should be put in place to address biological issues, as well as to govern the legal and institutional framework governing the safety of biotechnology and the equitable sharing of benefits. The adoption of a regional approach to establish such policies should be promoted.

12. Increasing public awareness of the benefits to be derived from biodiversity.

Public awareness campaigns that take advantage of the cultural and spiritual side of biodiversity should be developed. A less technical approach, involving the positive attitudes of the populace towards various ecosystems, should be adopted in preparation of public education programmes.

13. Developing public awareness of policies and laws relating to biodiversity.

The laws, regulations and procedures relating to the management and conservation of biological resources should be highlighted in workshops, radio and television programmes. Printed media spots should be used to educate resource users and the society at large. Support should also be provided for NGO's, community groups and service organizations that contribute to public education and stakeholder awareness.

5.4 ACTIVITIES TO ESTABLISH AND SUSTAIN INSTITUTIONAL ARRANGEMENTS FOR MANAGING THE BSAP

The multi-sectoral nature of biodiversity requires a co-ordinated management system. One of the main aims of the BSAP, therefore, is the achievement of an integrated, co-ordinated and inter-sectoral approach to biodiversity policy planning and management.

The following activities are identified in the BSAP in order to establish and sustain an institutional structure for effective management of the biodiversity of Antigua and Barbuda:

- Establishment of a co-ordinating mechanism or entity for attaining consensus and unified decisions on the implementation of the BSAP. The functions of such a mechanism include co-ordinating the formulation and implementation of national biodiversity policies and monitoring the implementation of the BSAP.
- Inclusion of stakeholders as a part of biodiversity planning and policy formulation.
- Support of a technically competent secretariat for the co-ordinating entity.
- Rationalization of the use of available manpower at the technical level, from the public, private and NGO sectors to support the co-ordinating mechanism and the changes that will need to be made in the legal and institutional structures.

It is expected that these measures will provide an enhanced framework for facilitating the type of policy co-ordination, information exchange, and co-ordinated management responses that will be required for enabling Antigua and Barbuda to implement the BSAP effectively.

CHAPTER 6

CONCLUSION

In Antigua and Barbuda, future actions to promote biodiversity in the context of sustainable development and the principles of the CBD will entail the evolution of actions relating to implementation of the Biodiversity Strategy and Action Plan (BSAP).

The BSAP provides an overall framework for managing and conserving biodiversity, building national capacity, and promoting public awareness of the significance of biodiversity in the Antigua and Barbuda context.

The overall goal of the BSAP is the sustainable management and utilization of biological diversity to enable it to contribute to the country's social and economic development.

In order for this to be achieved, a number of institutional and capacity building measures will need to be addressed, and these are an integral part of the BSAP.

An increasingly important issue for small island States like Antigua and Barbuda is that of bio-safety and biotechnology. While technological development in bioengineering presents enormous opportunities for food production and medicine, they also present tremendous risks in terms of potentially adverse effects for human welfare. Such dangers are magnified in the context of micro-States and point to the need for strengthening regional and international co-operation in these fields. Similarly, the increasing problem of invasive species also presents significant challenges and will require international responses through the mechanisms of the CBD.

Additionally, the threats presented by global climate change, ominous signals of which are already apparent in Antigua and Barbuda, also provide cause for concern in relation to adverse impacts on biodiversity resources in the country.

These developments come against the backdrop of continuing anthropogenic stresses on Antigua and Barbuda's fragile biodiversity resource. The implementation of the BSAP and measures for technical and financial support within the framework of the CBD, will be essential building blocks for ensuring that Antigua and Barbuda's rich natural resource heritage can continue to contribute towards the goal of sustainable development.

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LIST OF APPENDICES

APPENDIX I: Selected Wetlands Impacted by Development

Selected Sites	Wetland Type & Area	General Description	Status Conservation Issue & Concerns
The Cove	Fringe & Basin Mangrove Approx. 7.5 h.a.	Originally narrow fringe in embayment and around small shoals. Change in 90s. Major portion destroyed by deposition of dredge spoils and sand mining.	Pollution from industrial and domestic discharges. Setting of dredge spoil into bay. No management structure.
Mckinnons	Basin Mangrove Approx. 7.5 h.a.	Largest natural pond on Antigua. Domestic change over last 15 years. Sea access closed. Coastal Tourism Development industrial pollutants.	Degradation of system due to Coastal development. Need to restore system as habitat for fauna, fisheries nursery and drainage basin. No Management Structure.
Elys Bay/use Jabberwock problem Salt Pond	Basin Mangrove Approx. 7.5 h.a.	Fringe Mangrove around salt pond isolated behind wide sand barrier. Pond receives runoff from surrounding water shed, which is generally wooded.	Change in vegetation from by picnikers, solid waste clearing of vegetation for home construction, dumping of construction waste. No management structure.
Parham Harbour Fitches Creek	Eustuarine & Fringe Mangrove Approx. 60 h.a.	An almost unbroken stretch of mangrove in Parham 2 broad areas. Fitches Creek Mangrove lined channel.	Negative impacts from industrial works – effluents from desalination & power generation plants. No management structure.
Bethesda/Christian Cove	Basin and Fringe Mangrove & small Freshwater marsh Approx. 22 h.a.	Large basin with Mangrove border	Landfill, solid waste disposal, Housing encroachment, siltation. Needs protection. Potential for ecotourism, boardwalk and bird watching.
English Harbour	Basin and Fringe Mangrove	Narrow fringe on eastern side of harbour. Extensive open areas with vegetation.	Basin is used to discard waste & garbage over the years. Accelerated siltation has lost wetland characteristic. System continues to diminish. Part of Nelson's Dockyard National Park but receives no attention.

Fish Pond/ Carlisle Bay	Basin 21.7 h.a.	A dense stand of mangrove just beach. Long narrow deep pond, formerly a channel called the "Fish Pond".	Destruction caused by Hurricane Luis & Marilyn in 1995 & Georges in 1998. One tenth (1/10) of the area reclaimed for hotel expansion garbage disposal problem, siltation. Part of Cades Bay Marine Reserve in May 1999. Management plans being outlined. Monitoring by Fisheries Dept.
Cades Bay	Basin 18.1 h.a.	Dense mangrove system behind Goat Hill smaller system west of Cades Bay.	Beach at Goat Hill destroyed by sand mining. Mangroves in good health. Swath of mangroves destroyed for jetty construction. Quarterly and annual monitoring by Fisheries Dept. Part of Cades Bay Marine Reserve.
Urlings	Fringe and basin Approx. 17 h.a.	Fairly extensive mangrove with complex shallow ponds, basin & salinas.	Damages from hurricanes 89-99. Solid Waste problem; road rehab & extension filling parts of Northern area. Part of Cades Bay Reserve. No management plans yet.
DarkWood	Basin Approx. 3.5 h.a.	Pond trapped behind barrier. Fresh water marsh.	Complete degradation of system Over the past 30 years. Extensive sand mining during this time. Hurricane damages.
Yepton's	Salt Pond basin	Shallow basin mangrove. $\frac{3}{4}$ of pond dries up in dry season.	Natural channel to sea blocked when Hotel was built. Owner tried to drain and fill salt pond. $\frac{2}{3}$ of pond destroyed. DCA ordered owner to restore pond. No information on Management Structure.
Airport Road/ Pigotts	Basin Approx.	Shallow fresh water system. Marsh dries out completely during severe dry periods.	Most of system completely filled with construction and solid waste to create land for Commercial development. System will be lost or seriously altered within next few years. No management structure.
Barbuda Lagoon including the Bird Sanctuary	Basin Approx.	19.5 sq. ml.	Sizable, integrated and complex ecosystem. Very important nursery area for marine life, especially lobster. Turtle-nesting beaches along enclosing bar. Sanctuary for a colony of frigate birds.

APPENDIX II: Proposed Marine Reserves for Antigua and Barbuda

Area of Mangal	Approximate Central Location	Approximate Size (1991)	Reasons for Selection As Marine Reserve
Hanson Bay and the Flashes	West (17° 06' N, 61° 53' W)	225 ha.	Large system that suffered extensively from storms and the effects of anthropogenic activities. Has strong potential for recovery. Important to fisheries and the marine environment.
Pinching Bay Mangals	West (17° 06' N, 61° 54' W)	2 ha.	A healthy system that has some potential for fisheries. Very little degradation, thus the need for protection.
Yorks Salt Pond	West (17° 05' N, 61° 54' W)	1 ha.	Important nursery area for marine organisms. Used to be a safe haven during storms.
Area from Johnson's Point to Old Road Bluff	South-South-West (17° 01' N, 61° 52' W)	8 sq. ml.	A mangal system, linked to coral reefs and sea grass beds with a strong potential for fisheries support. Important nursery area for several marine organisms especially the queen conch. Needed to maintain the integrity of fisheries and protect its biodiversity.
Willoughby Bay/ Christian Cove	Southeast (17° 02' N, 61° 43' W)	5 sq. ml.	Linked to sea grass beds and offshore coral reefs. Supports important fisheries activity including cockle harvesting. Sizable system with some degradation and therefore should be protected.
Area between Green Island and Indian Town Point	Southeast (17° 05' N, 61° 45' W)	70 sq. ml.	Ideal assemblage of mangroves, sea grass beds and offshore coral reefs. Important nursery area for marine fauna. Still in fairly healthy condition.
Point Northeast Area from Boon Point to Indian Town	Entire Northeast Area (17° 09' N, 61° 45' W)	70 sq. ml.	Complex, fully integrated system with a variety of mangroves, coral reefs and sea grass beds. Includes rare animal species, especially on Bird Island and Guiana island. Important nursery area for conch and many other marine organisms. Will lend itself well and can be used as a model for integrated management. Turtle nesting sites located on offshore islands and on mainland beaches. Also a foraging area for sea turtles.
Barbuda Lagoon including the Bird Sanctuary	(17° 40' N, 61° 50' W)	19.5 sq. ml.	Sizable, integrated and complex ecosystem. Very important nursery area for marine life, especially lobster. Turtle-nesting beaches along enclosing bar. Sanctuary for a colony of frigate birds.

(Source: Antigua and Barbuda Fisheries Division)