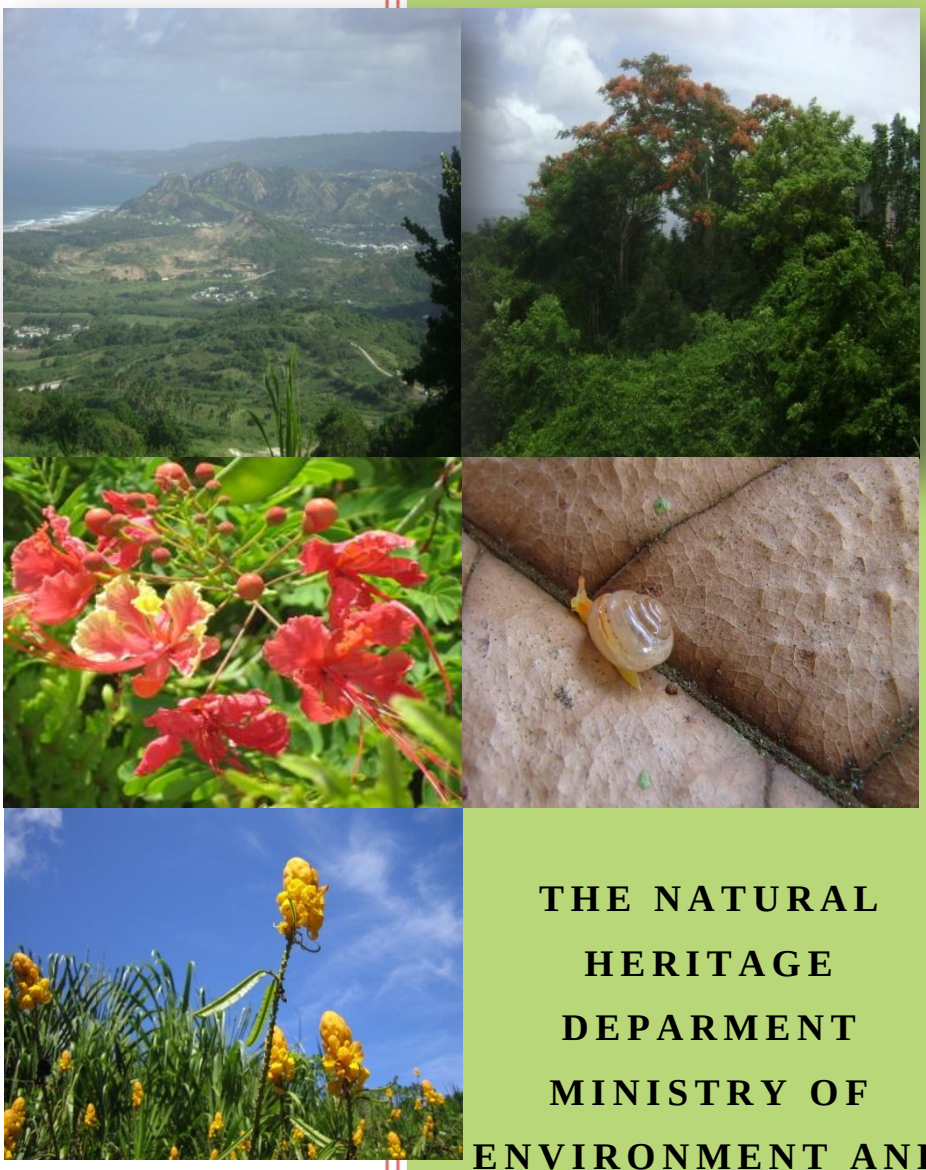
2011

BARBADOS' FOURTH NATIONAL REPORT TO THE CONVENTION ON BIOLOGICAL DIVERSITY (CBD)



THE NATURAL HERITAGE DEPARMENT
MINISTRY OF ENVIRONMENT AND DRAINAGE

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Preface

The Fourth National Report of Barbados to the United Nations Convention on Biological Diversity (CBD) is submitted in accordance with the Conference of Parties decision VIII/14. This report has been developed in accordance with the guidance provided in the 'Guidelines for the Fourth National Report'. Barbados' Fourth National Report is organized around four main chapters, and includes information on the country's progress towards the targets of the Global Strategy for Plant Conservation and the Programme of Work on Protected Areas. The four main chapters are:

i. Overview of Biodiversity Status, Trends and Threats.
ii. Current Status of National Biodiversity Strategies and Action Plans.
iii. Sectoral and Cross sectoral integration or Mainstreaming of Biodiversity Consideration.
iv. Conclusions - Progress Towards the 2010 Target.

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ABBREVIATIONS AND ACRONYMS

BARNUFO	Barbados National Union of Fisherfolks Organization
BMT	Barbados Marine Trust
BNT	Barbados National Trust
CaMPAM	Caribbean Marine Protected Area Management
CARDI	Caribbean Agricultural Research & Development Institute
CBD	Convention on Biological Diversity
CBO	Community Based Organization
CERMES	Centre for Resources Management and Environmental Studies
COP	Conference of the Parties
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
CZMU	Coastal Zone Management Unit
EIA	Environmental Impact Assessment
EPD	Environmental Protection Department
EU	Environment Unit
FAO	Food and Agricultural Organization
FPMR	Folkestone Park and Marine Reserve
GDMP	Green Deficit Management Programme
GEF	Global Environment Facility
GIS	Government Information Service
IADB	Inter American Development Bank
IUCN	International Union for Conservation of Nature
INTA	Integrated Nature Tourism Area
LLCS	Low Lying Coastal States
MAR	Ministry of Agriculture
MED	Ministry of Environment and Drainage
MOH	Ministry of Health
NBSAP	National Biodiversity Strategy and Action Plan
NCC	National Conservation Commission
NHCA	Natural Heritage Conservation Areas
NGO	Non governmental Organizations
NHD	Natural Heritage Department
NSP	National Strategic Plan
PDP	Physical Development Plan
RAMSAR	The Convention for the Protection of Wetlands especially as Waterfowl Habitats
SIDS	Small Island Developing States
TCDPO	Town and Country Development Planning Office
TMP	Tourism Master Plan
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
UWI	University of the West Indies
WIDECAST	Wider Caribbean Sea Turtle Network

3 ACKNOWLEDGEMENTS

The Natural Heritage Deparment (NHD), Ministry of Environment and Drainage (MED) acknowledges the contribution of experts from the government departments, academia, non-governmental organizations (NGOs), the private sector and community based organizations (CBOs) who provided feedback during the preparation of the Fourth National Report to the Conference of the Parties (COP) of the Convention on Biological Diversity (CBD) through written contributions, interviews and peer review.

The compilation of this document was due to a collaborative effort between the consulting team, the Natural Heritage Department and the Working Group on Biodiversity. The efforts of the drafting team and the contributions of the persons who participated in the technical working session for the preparation of the Fourth National Report are acknowledged.

The Ministry thanks the United Nations Environment Programme (UNEP) and the Global Environment Facility (GEF) for the financial assistance provided to produce the document.

4 EXECUTIVE SUMMARY

The Natural Heritage Department (NHD) of the Ministry of Environment and Drainage (MED) is responsible for the implementation of the obligations of the Convention on Biological Diversity CBD). The NHD also chairs a multi-sectoral Working Group on Biodiversity, which oversees this process. The NHD currently has a work programme in place for the conservation and sustainable use of biodiversity in Barbados.

The terrestrial fauna of Barbados consists of 9 mammal species, 261 species of birds[1], 10 extant terrestrial reptiles, 2 amphibians and approximately 1320 species of Insects and Allied Arthropods. These species inhabit various habitat types across the island. The plant communities of Barbados are classified according to the types of environments to which they are associated namely: gullies; forests; coastal wetlands; (beaches, sand dunes and sandy beaches); rocky land and inland cliffs and sea cliffs and sea rocks. Approximately 700 species of native and naturalized flowering plants have been described and approximately 100 of these are trees. Forest tree cover is estimated at 2-4% of land cover and can be found mainly in gullies, coastal woodlands, under cliff woods and other planted wooded areas.

Approximately 990 genera and 1548 species of organisms have been identified in the marine and freshwater ecosystems of Barbados[2] and these include the commercial fishery resources. There are nine main local marine fisheries which may be divided into four groups; the nearshore shallow reef resources, offshore deep slope resources, coastal pelagic resources and offshore pelagic resources[3]. Further, a diversity of freshwater ecosystems exist and these include: streams, ponds, temporary pools, and inland brackish water marshes and swamps.

The NBSAP details activities that are essential for improving biodiversity management in Barbados. The overall goal, specific objectives and strategies which form the foundation of the NBSAP attempt to address the range of issues relevant to the management of biodiversity. However, there still remains no formal monitoring and reporting system in place to measure the extent to which the activities have been carried out and how they have impacted on achieving the objectives. Continued cooperation among the government, private sector, communities, NGOs, academia and regional and international institutions has resulted in significant progress being made in some areas, but many challenges still remain and these have slowed the rate at which the NBSAP has been implemented.

Over the years, there has been a significant amount of work done in the areas of research and conservation of some key local species. The major administrative achievements have been identified as the establishment of the Natural Heritage Department, the development and implementation of various management plans and enhanced cooperation through the establishment of successful Inter-sectoral Committees which contribute to the management and conservation of biodiversity. The NBSAP document provides a wealth of information and if effectively utilized can coordinate the activities of the many stakeholders working in the area of biodiversity conservation and management. However, some of the key challenges

[1] Watson, K. (2009) "Review of Birds of Barbados". *Journal of Barbados Museum & Historical Society* LV: 296-299
[2] Government of Barbados, 2000. State of the Environment Report
[3] Government of Barbados, 2002. National Biodiversity Strategy and Action Plan

impacting on the effectiveness of the NBSAP and overall biodiversity conservation and management are as follows:

- The inordinate length of time it takes for draft legislation to be finalized and enacted.
- The lack of enforcement of existing legislation
- The increased pressure placed on species populations as a result of habitat destruction and reduction in food supply.
- The lack of staff within the MED to implement biodiversity conservation and management programmes
- The absence of a formal system in place for monitoring and reporting on the progress of the NBSAP

The protection and management of biological resources is shared among various entities. These agencies vary in their mandates and responsibilities and include governmental, non-governmental, academic and other major groups. These bodies vary in their roles depending for example on whether they are technical, policy oriented, administrative, or advisory in nature. The challenge therefore is to ensure adequate coordination across these different bodies. Efforts at ensuring coordination are both formal and informal including the establishment of multi-disciplinary and multi-agency steering committees, formal Memoranda of Understanding and less structured arrangements based on good-will among stakeholders. Some progress has been achieved in biodiversity management through these institutional arrangements but further improvement can be achieved with the provision of adequate resources.

The Environmental legislation associated with biodiversity conservation and management currently in force in Barbados is dispersed across several statutes and departments of government. Some pieces of legislation were prepared long before the modern environmental movement and therefore were not intended to address current issues and environmental concerns. There is a need therefore to modernize the legal framework governing the conservation and protection of biodiversity. In addition, there is also currently no comprehensive legislation in Barbados governing terrestrial protected areas.

The Government of Barbados' remains committed to the management and conservation of its limited biodiversity resources. However, more work needs to be done to integrate these plans and programmes that are promoted by the NBSAP. This will give effect to the changes necessary to improve the management of biodiversity on the island while avoiding further degradation of natural habitats and loss of native species. In addition, a review of the NBSAP taking into consideration the work that has already been done to date and the current national policies, plans and programmes will be necessary in order to assess the relevance of the objectives as set out in the document and further implement the relevant provisions of the Convention. Further, the development of monitoring and assessment tools are necessary in order evaluate the progress and effectiveness of the conservation and management work being conducted on the island.

Going forward, the implementation of the National Park Plan and the management of alien invasive species will be the key areas of focus for the Natural Heritage Department as it continues to work toward the implementation of the Convention on Biological Diversity at the national level.

5 OVERVIEW OF BIODIVERSITY STATUS, TRENDS AND THREATS

5.1 INTRODUCTION

A summary of the overall status of Barbados' terrestrial and marine biodiversity is presented in this chapter. The following sections also provide an explanation of the principle threats to biodiversity, their impacts on the environment and a discussion of the implications of biodiversity loss for human wellbeing. Barbados does not have the ability at this time to provide time series data to qualify and compare trends related to all species which inhabit the island. However, it is hoped that this information will become available in future reports.

5.2 COUNTRY PROFILE

Barbados is the most easterly island of the Eastern Caribbean island chain. The island is 34 kilometres (km) long and 23 km wide and has a total land area of approximately 432 square km or 166 square miles. The Exclusive Economic Zone (EEZ) of the country is 167,000 square km.

Barbados has a dry sub-humid climate with temperatures ranging between 20°C and 30°C . The dry season falls between January and May and the wet season falls between June and December. The average annual rainfall of Barbados is approximately 50 inches (1254 mm) in the lower elevations and an estimated 66 inches (1650 mm) in higher elevations. Most locations receive between 56 and 60 inches of rainfall annually. Barbados has a limited amount of surface water, and as a result, the island is almost completely dependent on groundwater abstracted from the island's underlying aquifers.

Approximately eighty six percent of the island is comprised of a karst topography, rising in a series of limestone terraces towards the centre of the island. A series of deep gullies which facilitate the movement of water during heavy rainfall also radiate from the centre of the island. There are no permanent rivers in Barbados. The remaining fourteen percent of the land area which is located in the northeast of the island is called the Scotland District and is comprised of sedimentary deposits (sands, shales and clays). These layers are highly folded and faulted and result in land slippage being common in the area. The East coast of the island is a high wave energy coastline that is characterized by high cliffs and headlands that are battered by strong surf, while the West and South coasts represent low wave energy coastlines characterized by sandy beaches and calmer waters.

Barbados' total land area of approximately 432 km^2 is home to an estimated population of 276,302 as at December 2010[4]. The island is ranked as the 16th most densely populated country in the world, with a population density of approximately 622 per/Km^2. In addition to the resident population, the island as a tourism destination continues to welcome a significant number of long stay and cruise ship visitors. In 1956 there were 17,829 long stay and 12,391 cruise ship visitors. By 2010 these numbers had increased to 532,180 long stay visitors and

[4]Barbados Statistical Service, 2011. Estimated Population as at the End of 2010.www.barstats.gov.bb.28 May2011

664,747 cruise ship visitors[5]. The visitors to the island frequent the parks, beaches, open spaces and country side which are home to the island's biodiversity.

The majority of the country's population is settled along the south-east, south and west coasts of the island. It is believed that 'suburbanization' from the capital city Bridgetown will continue, leading to the gradual increase in densities to the northwest, north and east of Bridgetown, while most other areas will remain relatively constant[6]. The expansion of the population will have more serious implications for the conservation of biodiversity on an island with an already finite resource base.

5.3 OVERVIEW OF THE BIODIVERSITY OF BARBADOS

The Government of Barbados ratified the Convention on Biological Diversity (CBD) on December 10, 1993 and is therefore responsible for ensuring that the country maintains compliance with the Convention. The Natural Heritage Department (NHD) of the Ministry of Environment and Drainage (MED) is responsible for the implementation of the obligations of the CBD. The Department also chairs a multi-sectoral Working Group on Biodiversity, which oversees this process. The NHD currently has a work programme in place for the conservation and sustainable use of biodiversity in Barbados.

Barbados is a small island developing state with limited land resources and a high population density. As a result of spatial limitations, Barbados has had to employ strategies, plans and programmes for the management and conservation of biological diversity which depend heavily on the cooperation of Government Agencies, the private sector, academia, non-governmental and community based organizations and the general public.

The plant communities of Barbados are classified according to the types of environments to which they are associated namely: gullies; forests; coastal wetlands; (beaches, sand dunes and sandy beaches); rocky land and inland cliffs and sea cliffs and sea rocks. Forest tree cover is estimated at 2-4% of land cover (800-2000 ha) and can be found mainly in gullies, coastal woodlands, under cliff woods and other planted wooded areas. It is noteworthy to mention that gullies account for approximately 5% of the land area and contains as much as 35% of native plant diversity[7].Please refer to Table 1.

[5]Barbados Statistical Service, 2011. Comparison of Tourism Arrivals By Country of Residence December 2009 and 2010.www.barstats.gov.bb/files/documents/December_2009_and_2010compared.pdf.[28 May2011]

[6] CaribInvest West Indies Limited, Draft Diagnostic & Analytical Review of Environmental Governance Systems, 2009

[7] Austin, M. L.2005. '*Methodological Study to Assess Vegetation Cover Changes in Barbados. A research paper submitted in partial fulfilment of the requirements for MSc. In Natural Resource and Environmental Management of the University of the West Indies*

Table 1 : Forest Coverage in Barbados by Area

Name	Area (ha)	Description
Turner's Hall Woods	30	Natural forest
Joe's River Forest	39	Natural Plantation forest
Under cliff and Gully Woodlands	500	
Bawdens & Greenland	8	Young plantation forest
Mangrove & Wetlands	64	

In addition, several man-made habitats namely: plantation forests, sugar cane plantations, pastures, sugarcane fields, roadsides, ponds and streams and miscellaneous waste sites serve as also serve as terrestrial ecosystems.

Figure 1: Forested area in the East of the country

The terrestrial fauna of Barbados consists of 9 mammal species, 261 species of birds[8], 10 extant terrestrial reptiles, 2 amphibians and approximately 1320 species of Insects and Allied Arthropods. These species inhabit various habitat types across the island.

The marine area of Barbados extends over approximately 48,800 km^2 with a shelf area of approximately 320 km^2. Barbados' total reef area is estimated at 90 km2 (Burke and Maidens 2004).[9] Approximately 990 genera and 1548 species of organisms have been identified in the

[8] Watson, K. (2009) "Review of Birds of Barbados". *Journal of Barbados Museum & Historical Society* LV: 296-299

[9]The Faculty of Pure and Applied Sciences, Centre for Resource Management and Environmental Studies, 2006.*Community Based Coral Reef Monitoring and Management Project*.[6 December 2010] http://www.cavehill.uwi.edu/cermes/folkestone.html

marine and freshwater ecosystems of Barbados[10] and these include the commercial fishery resources. There are nine main local marine fisheries which may be divided into four groups; the nearshore shallow reef resources, offshore deep slope resources, coastal pelagic resources and offshore pelagic resources[11]. Further, a diversity of freshwater ecosystems exist and these include: streams, ponds, temporary pools, and inland brackish water marshes and swamps.

Overall, Barbados' biological diversity (biodiversity) is classified according to three broad ecosystems namely: Terrestrial Biodiversity, Freshwater Biodiversity and Marine Biodiversity and the proceeding sections detail the status and trends of the key species that inhabit these ecosystems.

[10] Government of Barbados, 2000. State of the Environment Report
[11] Government of Barbados, 2002. National Biodiversity Strategy and Action Plan

5.4 STATUS AND TRENDS OF BIODIVERSITY

5.4.1 STATUS AND TRENDS OF TERRESTRIAL BIODIVERSITY - FLORA

Approximately 700 species of native and naturalized flowering plants have been described and approximately 100 of these are trees. Two (2) of these plant species are only found in wooded areas and are considered to be endemic[12]; 8 species as rare or endangered and 23 species have been identified as requiring protection in Barbados although they are found in other countries in the Lesser Antilles[13]. Fifteen of these species are also known to be found at only one site.[14] Further, recent research has resulted in 15 flowering plants being identified for possible inclusion in the island's flora; and eight of these species (*Philodendron lingulatum, Hymenocallis latifolia, Hymenocallis speciosa, Mimosa distachya, Macroptilium atropurpureum, Sapindus saponaria, Canella winterana* and *Psychotria microdon*) are new records for Barbados.[15]

Research on lower plants remains limited however, Carrington 1991 lists the fern ally (*Psilotum nudum)* and a tree fern *Cyathea arborea* as rare or endangered. In addition, some of the *Bryophytes* and *Pteridophytes* in Barbados have also been inventoried however, the research conducted on these species is limited and therefore their status is unclear.[16]

Over the years, 28 sedge species[17] and 79 grass species[18] have been described. In addition, 222 algal species ; 37 species of *Pteridophytes.*[19]; 9 macrofungi, 4 lichens, 22 species of mosses, 4 species of liverwort and 1 hornwort species have been documented on the island[20].

5.4.2 STATUS AND TRENDS OF TERRESTRIAL BIODIVERSITY - FAUNA

5.4.2.1 BIRDS

To date, two hundred and sixty one (261) species of birds have been recorded in Barbados[21], this represents an increase from the estimate of just over 150 which was reported in the 2002 NBSAP. The recorded species comprise of over 230 migratory bird species of which 5 species are of global importance.[22] Further, there are 34 species of bird breeding on the island and this number also includes some exotics. [23] Of the 34, 31 have been identified as native breeding

[12] Government of Barbados, 2002. National Biodiversity Strategy and Action Plan
[13] *Ibid*

[14] Government of Barbados, 2002. National Biodiversity Strategy and Action Plan, Comments of Carrington, S. in (1991),.

[15] Carrington, C.M.S. 2004. "New Collections for the flora of Barbados III". *Journal of Barbados Museum & Historical Society* 50: 28-39
[16] *Government of Barbados, 2002. National Biodiversity Strategy and Action Plan*
[17] Rogers, G. & B. McClain. 1998. The sedges (Cyperaceae) of Barbados.Rhodora 100:389
[18] Rogers, G. and A. Holder (1999) *The Grasses of Barbados (Poaceae).* Sida, Botanical Miscellany 17
[19]Chinery, L.E, 1999, *Checklist of Barbadian Ferns,* http:scitec.uwichill.edu.bb/bcs/staff/lec/Bdosfern.htm, [6 December, 2010]
[20] Government of Barbados, 1998. *Background Biophysical Report – The National Natural Resources Database,* Environmental Management and Land Use Planning for Sustainable Development
[21] Watson, K. (2009) "Review of Birds of Barbados". *Journal of Barbados Museum & Historical Society* LV: 296-299
[22] Burke, Wayne, 2007, "Final Report *Waterbirds in Barbados"*Waterbirds Conservation for the Americas
[23]Watson , K. (2009) "Habitat Change and Wildlife in Barbados with Special reference to Birds". *Journal of Barbados Museum & Historical Society* L: 296-299

species, one of which, the *Barbados Bullfinch Loxigilla barbadensis*, is endemic[24]. Approximately 16 bird species have been categorized as exotics (8 of these species occur naturally due to an expanded range and 8 species have been deliberately introduced). Approximately 31 native and migratory species of birds are protected under the *Wild Birds Protection Act Cap 398.*

If is believed that the increasing number of fruit trees, secondary reforestation due to the abandonment of marginal sugar cane fields and the presence of a number of developments marked by the large scale planting of trees and the creation of artificial lakes and ponds has resulted in a resurgence of favourable habitat for some bird species and as a consequence, the number of breeding species has risen[25]. In addition, many migratory species have also been observed to be spending longer periods of time or even wintering on the island[26].

5.4.2.2 MAMMALS

The mammalian fauna of Barbados continues to be dominated by 6 species of bats (*Artibeus jamaicensis, Brachyphylla cavernum minor, Molussus molussus, Monophyllus plethodon plethodon, Myotis martiniquensis* and *Noctillo leporinus*)[27], the African green monkey *(Chlorocebus aethiops sabaeus),* mongoose *(Herpescus javanicus)* and the hare (*Lepus capensis*) which occupies a limited range. None of Barbados' mammals are endangered.

Surveys have been conducted to determine bat diversity and relative abundance in coastal, gully and cave sites on Barbados as part of a long- term monitoring programme[28]. However, the ecology and population of bats in Barbados remains poorly understood because few studies have been done on the island.[29]

The mongoose, *Herpestes javanicus*, is considered to be amongst the most serious of invasive species globally. The absence of predators of the mongoose in Barbados, and its omnivorous diet, has resulted in an observed increase in the mongoose population since its introduction during the colonial era. More quantitative information on the distribution and abundance of mongooses in Barbados remains unavailable[30].

The hare (*Lepus europaeus)* population in Barbados has oscillated over previous decades and a survey done in 1997 (by J. Horrocks) revealed that the hare populations were patchily distributed on an island-wide scale. They primarily occur in the higher, central area of the island typically in open grassy areas adjacent to sugarcane fields[31]. According to recent research, the hare population seems to be experiencing a resurgence and the explanations for

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[24] Buckley, P.A, et al 2009, '*The Birds of Barbados'*, British Ornithologists' Union

[25] Watson , K. (2009) "Habitat Change and Wildlife in Barbados with Special reference to Birds". *Journal of Barbados Museum & Historical Society* L: 296-299

[26] *Ibid*

[27] Grindal, Scott. D., 2004, "*Notes on the Natural History of Bats on Barbados" Journal of Barbados Museum & Historical Society* Volume L: 9-27

[28] *Ibid,*

[29] *Ibid*

[30] Government of Barbados, 2002, *National Biodiversity Strategy and Action Plan*

[31] Vandeyar, A., Suchentrunk, F. and Horrocks, J.A, 2010, 'A New *Study of the Hare (Lepus europaeus) in Barbados', Journal of the Barbados Museum and Historical Society LVI 141-147*

the more recent increases are: that there are now more grassland than there was formerly and, possibly because less harmful pesticides are being used than previously[32]. The *Vandeyar et al* study of the local hare also indicated that the hare population may be differentiated from the ancestral European population and may have a reduced genetic diversity. Molecular DNA genetic diversity, morphological and physiological studies are currently being conducted in this regard[33].

The African Green monkey *Chlorocebus aethiops sabeus* population was first assessed in 1980, at the onset of trapping by the Monkey Crop Damage Control Programme. A total of 14,200 monkeys was estimated from that survey (CARDI 1981, Boulton et. al 1996). The population was assessed again in 1994 and was estimated at 14,792(Boulton et. al 1996). Their distributional preference for wooded areas supports the evidence to suggest that the population size of green monkeys in Barbados may be limited more by the availability of woodland cover, which they use for refuge and food, than by predation (Boulton et al. 1996; Horrocks 1985)[34]. The African green monkey population has remained relatively constant between 1984 and 1994 in spite of increased trapping and hunting which was done heavily in the past and the new threat of increasing urbanization[35]. However, the current status of the African green monkey is unknown.

5.4.2.3 REPTILES

The terrestrial reptile population of Barbados is comprised of snakes, lizards and tortoise species. Four snake species namely: (*Leptotyphlops carlae, Ramphotyphlops braminus, Liophis perfuscus* and *Mastigodryas bruesi*) have been recorded for Barbados.

Three species of snake are extant on the island; two are introduced and the other is endemic. A fourth species, endemic to the island is thought to be extinct[36]. Of note, is the Barbados thread snake (*Leptotyphlops carlae)* which, on the basis of morphological and molecular data is recognized as endemic to Barbados (see Figure 2). This species is very rarely seen but confirmed sightings have occurred in three parts of the island. Little is known about the biology of this species and the status of the population is unknown.

Figure 2: Thread snake (*Leptotyphlops carlae*)

[32] Vandeyar, A., Suchentrunk, F. And Horrocks, J.A, 2010, *A Study of the Hare (Lepus europaeus), Journal of the Barbados Museum and Historical Society.Vol LVI 141- 147*
[33] Vandeyar, A., Suchentrunk, F. And Horrocks, J.A, *A Study of the Hare (Lepus europaeus), Journal of the Barbados Museum and Historical Society. (In Press)*
[34] Government of Barbados, 2002, National Biodiversity Strategy and Action Plan
[35] *Ibid*
[36] *Ibid*

In addition, eight lizard species namely: (*Hemidactylus mabouia, Phyllodactylus pulcher, Gymnophthalmus underwoodi, Anolis extremus, Anolis sagrei, Mabuya mabouya, Ameiva maeiva* and *Kentropyx Borckiana*) have been documented. Of the 8, two species *Anolis sagrei* and the teiid *Ameiva ameiva,* have been recently introduced[37].

Figure 3: The Green lizard (*Anolis extremus)*

The status of the lizard species which inhabit the island has been characterized as mixed. The leaf toed gecko *Phyllodactylus pulcher* is endemic to Barbados, however, this species has not been seen in recent years[38]. Further, there have been no confirmed sightings of the skink *Mabuya mabouya* on the island in the past fifty years. The status of these 2 species is currently unknown. The population of *Kentropyx Borckiana* is currently expanding and thriving in residential areas. However it is not known at this time whether the current population is the result of a recent re-introduction or a resurgence of the original population which was known to exist on the island from the 1800s[39]. Generally the other species are common but no population studies have been done to determine the status of lizard species.

Figure 4: Leaf toed gecko (*phyllodactyllus pulcher*)

[37] Fields, A and Horrocks, J.A. 2009, 'An Annotated checklist of the Herpetofauna of Barbados, *Journal of the Barbados Museum and Historical Society LV263-283*

[38] D. Corrie, Caribbean Herpetological Society, pers.comm. Nov 2003, Fields, A and Horrocks, J.A. 2009, 'An Annotated checklist of the Herpetofauna of Barbados, *Journal of the Barbados Museum and Historical Society LV263-283*

[39] Fields, A and Horrocks, J.A. 2009, 'An Annotated checklist of the Herpetofauna of Barbados, *Journal of the Barbados Museum and Historical Society LV263-283*

Geochelone carbonaria is the lone tortoise species inhabiting the island. A breeding population is not known to exist in the wild but occasionally adult individuals are seen in gullies.[40] Large captive breeding populations are maintained by individuals involved in the pet trade and by the local wildlife reserve. Red footed tortoise are considered of conservation concern globally and are listed in CITES Appendix II.[41]

In 2006 the Government of Barbados enacted The International Trade in Endangered Species Act, 2006-3 which protects some local species not listed on the CITES Appendices, but whose populations may be threatened by trade. The species listed in this act include: the frog *Eleutherodactylus johnstonei*, the lizards *Hemidactylus mabouia*, *Anolis extremus*, *Kentropyx borckiana* and *Gymnohthalmus underwoodi*, and the snakes *Liophis perfuscus*, *Mastigodryas bruesi* and *Leptotyphlops bilineata*. The legislation needs to be amended to provide protection to *L. carlae*. There is currently no specific protection of habitat for rare and endangered terrestrial herptiles in Barbados.[42]

[40] Fields, A and Horrocks, J.A. 2009, 'An Annotated checklist of the Herpetofauna of Barbados, *Journal of the Barbados Museum and Historical Society LV263-283*
[41] *Ibid*
[42] *Ibid*

5.4.2.4 AMPHBIANS

Two amphibian species the cane toad (*Chaunus marinus linnaeus)* and the whistling frog (*Eleutherodactylus* johnstonei) inhabit the island. These species are currently locally abundant wherever water is present[43]. Both species inhabit relatively stable habitats e.g. gullies and ponds and their diets, which consist of a wide range of species have contributed to the success of this species on the island[44].

Figure 5: Whistling frog (*Eleutherodactylus johnstonei*)

5.4.2.5 INSECTS AND ALLIED ARTHROPODS

To date approximately 1320 species of Insects and Allied Arthropods have been described. Among the insects, odonates, hemipterans, coleopterans and dipterans have been found to be the most common.[45]

[43] *Ibid*
[44] *Ibid*
[45] Bass, D, 2003. 'Freshwater Macroinvertebates of Barbados', *Journal of the Barbados Museum and Historical Society XLIX 269-280*

5.4.3 STATUS AND TRENDS OF FRESHWATER BIODIVERSITY

More than ninety (90) aquatic macroinvertebrate taxa have been identified for Barbados. However, generally the macroinvertebrate fauna is sparse and it is proposed that this is due to the oceanic origin of Barbados and the disturbance of freshwater environments across the island.[46]

The overall status and trends related to the taxa is unknown. However, work continues in this area and it is estimated that more species will be discovered. Almost half of the species encountered during research done were not previously known to exist in Barbados. The macroinvertebrate fauna of Barbados is dominated by snails, shrimps and insects. [47] As the dense population of Barbados continues to place increased pressure on the environment it will be important to recognize and protect freshwater habitats and the species they support.[48]

5.4.4 STATUS AND TRENDS OF MARINE BIODIVERSITY

Three species of marine turtles have been described for Barbados. The endangered Green turtle (*chelonian mydas)* which only feeds in the nearshore waters of the island while the remaining two species, the critically endangered Hawksbill (*Eretmochelys imbricate)* and the endangered Leatherback (*Dermochelys coriacea*) turtles nest in Barbados.

Green turtles are listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The conservation concerns for this species are boat strikes, entanglement in fishing gear and potential risk to overall health from eating an unnatural diet. The impact of provisioning on movements of animals away from Barbados as large juveniles is still unknown, however, tagging of these animals is routinely undertaken as part of the monitoring programme of the Barbados Sea Turtle Project (BSTP) of the University of the West Indies to investigate this (Horrocks et al, 2007).[49] The BSTP has been working to conserve endangered sea turtle populations in Barbados since 1987 and the overall goal of the project is to assist in the recovery of depleted populations of sea turtles on the island.

In the early 1990s the size of the nesting Hawksbill turtle population was estimated at 125 individuals (Horrocks, 1992). Since there are 2-3 year gaps for an individual female between nesting seasons, this meant that approximately 50 females nested per year. The numbers of nesting females have increased over the years with the most recent counts being over 400 females per year (Beggs et al, 2007; BSTP unpublished data).[50] Hawksbills are listed as critically endangered (IUCN, 2008) and are listed under Appendix I of CITES. A moratorium on sea turtle capture was instituted by the Barbados Government in1998 and this has significantly reduced the overharvesting threat to the hawksbill turtle population. Although poaching of nesting turtles still occurs on isolated beaches, the more serious threat to long

[46] Bass, D, 2003. 'Freshwater Macroinvertebates of Barbados', *Journal of the Barbados Museum and Historical Society XLIX 269-280,*
[47] *Ibid,*
[48] *Ibid*
[49] Fields, A and Horrocks, J.A. 2009, 'An Annotated checklist of the Herpetofauna of Barbados, *Journal of the Barbados Museum and Historical Society LV263-283*

[50] Ibid

term population stability remains the loss and deterioration of nesting habitats. In addition, disorientation of newly hatched turtles by coastal lighting continues to be a major cause of mortality. Beach erosion and encroaching sea level has also resulted in the washing out of a high percentage of nests in recent years.[51]

Figure 6: Hawksbill Turtle Leaving the Beach After Nesting

Leatherback turtles are not resident in Barbados' territorial waters but travel to Barbados to nest. To date about 100-200 leatherback nests are made annually. Leatherbacks are of conservation concern and are classified as critically endangered (IUCN, 2008) and listed on CITES Appendix I. Their habit of nesting on the isolated, high wave energy beaches on the east coast of the island has meant that they have not been as seriously affected by coastal development as the hawksbill turtle.

Four species of seagrasses have been recorded for Barbados (Delcan 1994, Vermeer 1997). They are *Thalassia testudinum* (turtle grass), *Syringodium filiforme* (manatee grass), *Halodule wrightii* (shoal grass), *Halophila sp*. However, Many coastal activities as well as land based sources of pollution have impacted negatively on the local seagrasses whose populations have declined over the years.

There are approximately 10 species of soft coral and 31 hard coral species which surround the island of Barbados. Studies conducted have revealed that overall there has been little net change in the number of species and abundance of hard corals between 1997 and 2007 (see Figure 2).[52]

[51] Fields, A and Horrocks, J.A. 2009. 'An Annotated checklist of the Herpetofauna of Barbados, *Journal of the Barbados Museum and Historical Society LV263-283*

[52] Government of Barbados, Coastal Zone Management Unit, 2008.*The Barbados Coral Reef Monitoring Programme – Changes in Coral Reef Communities on the West and South Coasts 1997-2007*

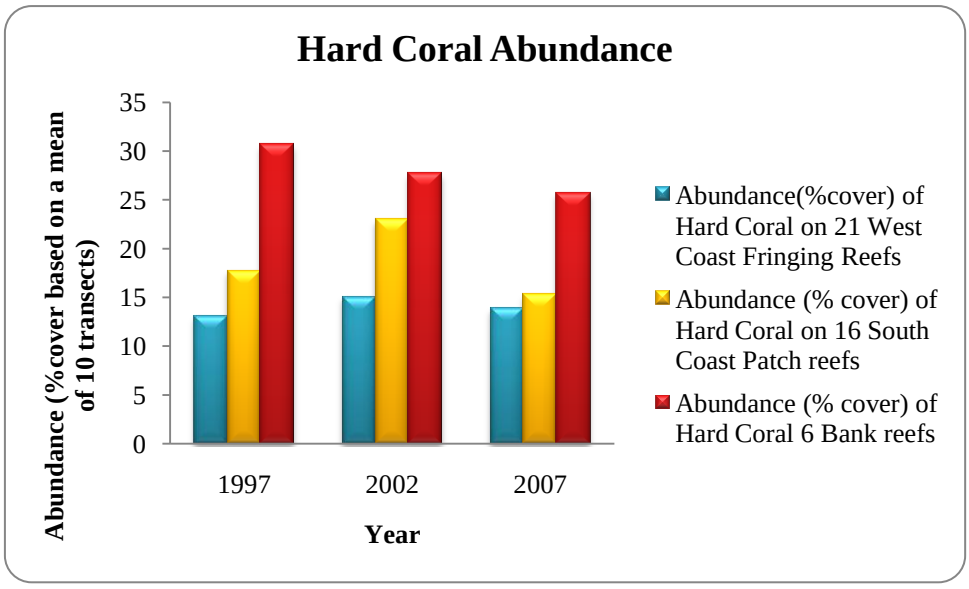

Figure 7: Abundance of Hard coral on West, South Coast and Bank Reefs

There was minimal change in the Soft coral abundance on the west coast fringing reefs between 1997 and 2007. However, on the south coast, soft coral abundance increased sharply between 1997-2002 but then experienced a sharp decrease between 2002 and 2007 (see Figure 3). The sponges have increased in abundance continuously on all reef system types over the 1997 to 2007 period. The increase in sponge abundance is the most consistent and noticeable change on Barbados' reefs over the past two decades.[53] Barbados' reefs remain relatively healthy and continue to support a rich and diverse community of marine fauna.

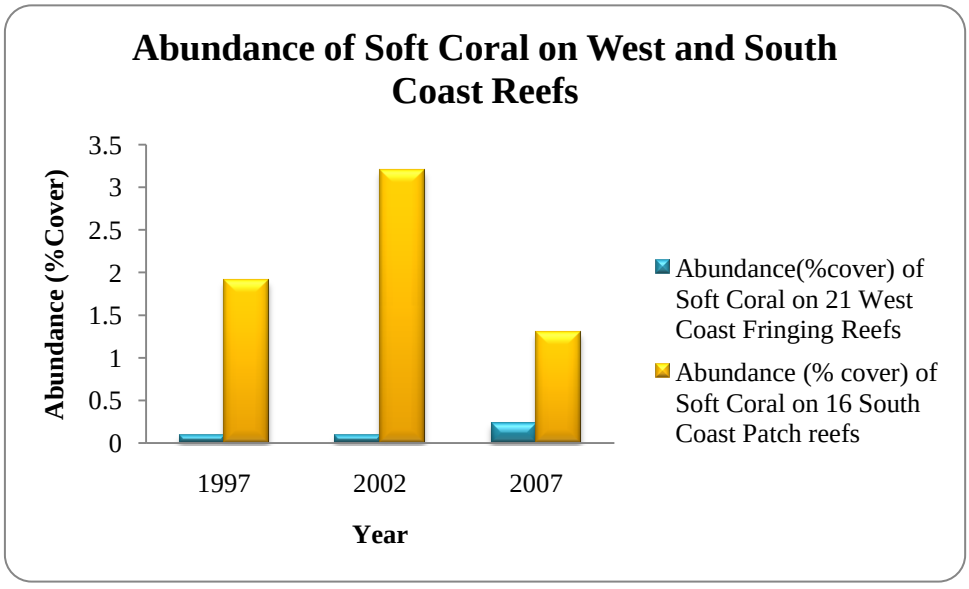

Figure 8: Abundance of Soft coral on West and South Coast Reefs

[53] Government of Barbados, Coastal Zone Management Unit, 2008.*The Barbados Coral Reef Monitoring Programme – Changes in Coral Reef Communities on the West and South Coasts 1997-2007*

In relation to the reef fish resource, reef fish abundance increased between 1997 and 2007 on West coast fringing reefs. However, reef fish abundance decreased on south coast patch reefs and changed little on the bank reefs over the decade (see Figure 5).[54] The number of reef fish species showed minimal change on west coast fringing reefs or bank reefs during the period 1997 and 2007, but decreased on south coast patch reefs.[55]Many south and west coast areas of shallow shelf reef fish populations have been overfished. The status of populations in the east coast areas is less well known.

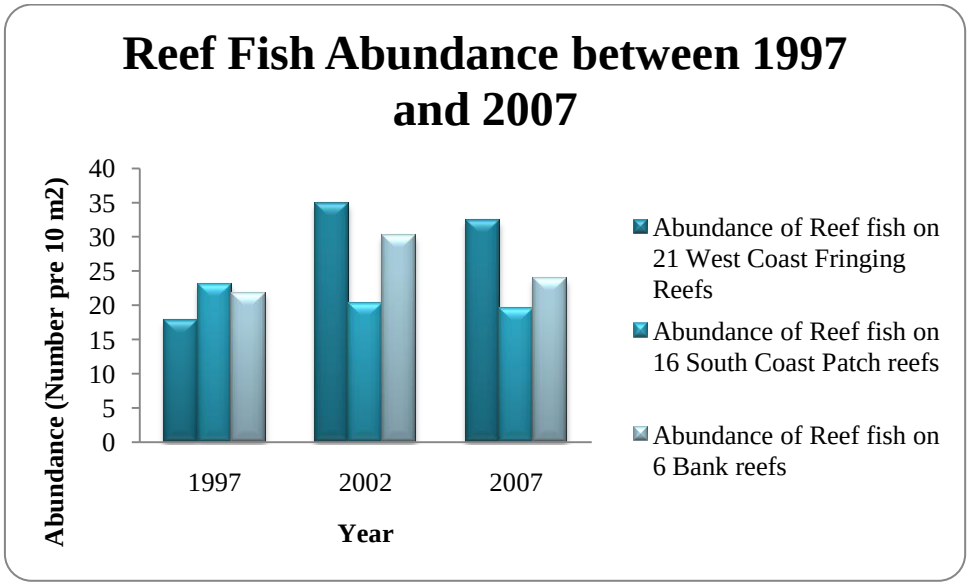

Figure 9: Reef Fish Abundance between 1997 and 2007

Managing the biodiversity resource in Barbados has been a challenge over the years. In this regard, Table 2 provides some information on general trends related to Biodiversity in Barbados. However, the Government of Barbados along with its partners in academia, the community and the private sector have been working together to develop and implement plans and programmes that seek to minimize negative impacts as the country continues to develop and move toward a green economy.

[54] Government of Barbados, Coastal Zone Management Unit, 2008. *Te Barbados Coral Reef Monitoring Programme – Changes in Coral Reef Communities on the West and South Coasts 1997-2007*
[55] *Ibid*

Table 2: Biodiversity Trends in Barbados

Biome/ Ecosystem Type	National Indicator[56]	Corresponding global Indicator (CBD)	Trends
Terrestrial	Land use: agriculture, land degradation, natural capital, coastal zone management, water, waste, Biodiversity: abundance & distribution of selected species as noted within the NBSAP, various pieces of legislation such as protected areas, plant varieties protection. Global warming/ Climate change: emission of greenhouse gases (e.g.CO2), Sea level rise, changes in sea water temperature Nationally designated protected areas Invasive Alien Species	Abundance and distribution of selected species Trends in extent of selected biome, ecosystems and habitats Genetic diversity Coverage of protected areas Red List Index (tracks species' IUCN Red List categorization through time) Areas under sustainable management Proportion of products from sustainable sources Ecological footprint	The general trend is a reduction in numbers due to habitat loss due to a decrease in agricultural activity and lands being cleared for real estate development Deliberate and inadvertent introduction of alien species which may become invasive Reduction in numbers of animal and plant species due to increasing number of annual grass, pasture and plantation fires
Marine	Coastal Zone Management: Catch per Unit effort /annual marine catch, Signs of overexploitation-changing composition of landings by species, Signs of overexploitation-changing composition of landings-decreasing size of individuals, seagrass beds, Terrestrial and marine water quality, Coral reef health, Mangroves, Coastal geomorphology, Algae index, Bacterial index, Fish kill events,	Marine Trophic Index Connectivity / fragmentation of ecosystems Water quality Health and wellbeing of communities Biodiversity for food and medicine	Reduction in fish stocks Increased incidence of fish kills Reduction in numbers of live soft and hard coral in some areas Fewer number of protected and endangered species Increased marine pollution

[56] There is a list of 170 indicators of sustainable development for Barbados (2000). A Pilot study was undertaken to test sub-set of 20 indicators (2000). Indicators are classified in 3 main areas: Human Well-being, Ecological Welfare and Sustainable Interactions; with 12 main sub-themes: health, education housing, social welfare, security, air, land-use, water, population, economic development, consumption and production patterns. (Source: Amrikha Singh, Ministry of Environment, Barbados – PowerPoint Presentation.

	Discharges in coastal water e.g. oil, ballast water etc., Release of nitrogen and phosphorus into coastal waters, Measured levels of marine pollution, Increase in physical development in coastal areas, User growth in coastal areas	Areas under sustainable management Proportion of products from sustainable sources Ecological footprint Ecological Quality Objectives (EcoQOs)16 of the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) Red List Index	Significant deterioration of health of coral reefs slight increase in coral abundance on west coast fringing and south coast patch reefs during the 1997 monitoring event Decreases in fish numbers as well as in the average sizes (especially in the reef fish caught)
Freshwater	Fresh water quality	Abundance and distribution of selected species Trends in extent of selected biomes, ecosystems and habitats Genetic diversity Coverage of protected areas Aquaculture effluent Ecological footprint	General reduction in the number of inland water catchment areas on the island
Agriculture	Agriculture land use Agro-biodiversity Agricultural chemical use Fertiliser use Products and services from agricultural enterprises Agricultural sector contribution of GDP, contribution to Foreign exchange, labour force in agriculture	Agricultural nitrogen balance Agriculture managed with biodiversity in mind Commercial fish stocks Aquaculture effluent Ecological footprint	Reduction in plantation sugar production Change of land use from agriculture to residential Increase in green house vegetable and herb production Trend to use imported exotic varieties and not indigenous traditional agricultural varies e.g. nuts, pumpkin Reductions of crop and livestock varieties due to selective breeding

5.5 THREATS TO BIODIVERSITY

5.5.1 CAUSES OF BIODIVERSITY LOSS IN BARBADOS

The major threats to biodiversity in Barbados are habitat loss and fragmentation, alien invasive species, overharvesting of species, pollution, unregulated shooting of birds, resource extraction and natural disasters. These threats not only contribute to species loss, but also alter natural habitats. These threats have been predominantly caused by a lack of awareness among the general public; urban growth; land tenure; land use and property rights issues and unsustainable marine resource exploitation (over population of the natural resource base, legal and institutional constraints and over fishing, illegal harvesting, diver and anchor damage and destructive fishing methods). The threats, drivers of the threats and their implications are outlined in Table 3.

5.5.1.1 HABITAT LOSS AND FRAGMENTATION

Habitat loss is an on-going challenge to biodiversity conservation in Barbados. One of the main drivers of habitat loss and fragmentation is the gradual urbanization and sub-urbanization of the island. Generally the island has been able to control haphazard development and urban sprawl through the implementation of a National Physical Development Plan (PDP) (see Figure 6). Since 1970 land use activity in the island has been regulated through a PDP. The PDP has been reviewed and updated periodically usually every 10 years. The PDP delineates the boundary between lands used for urban and residential uses from other lands used for country side, agricultural and conservation purposes.

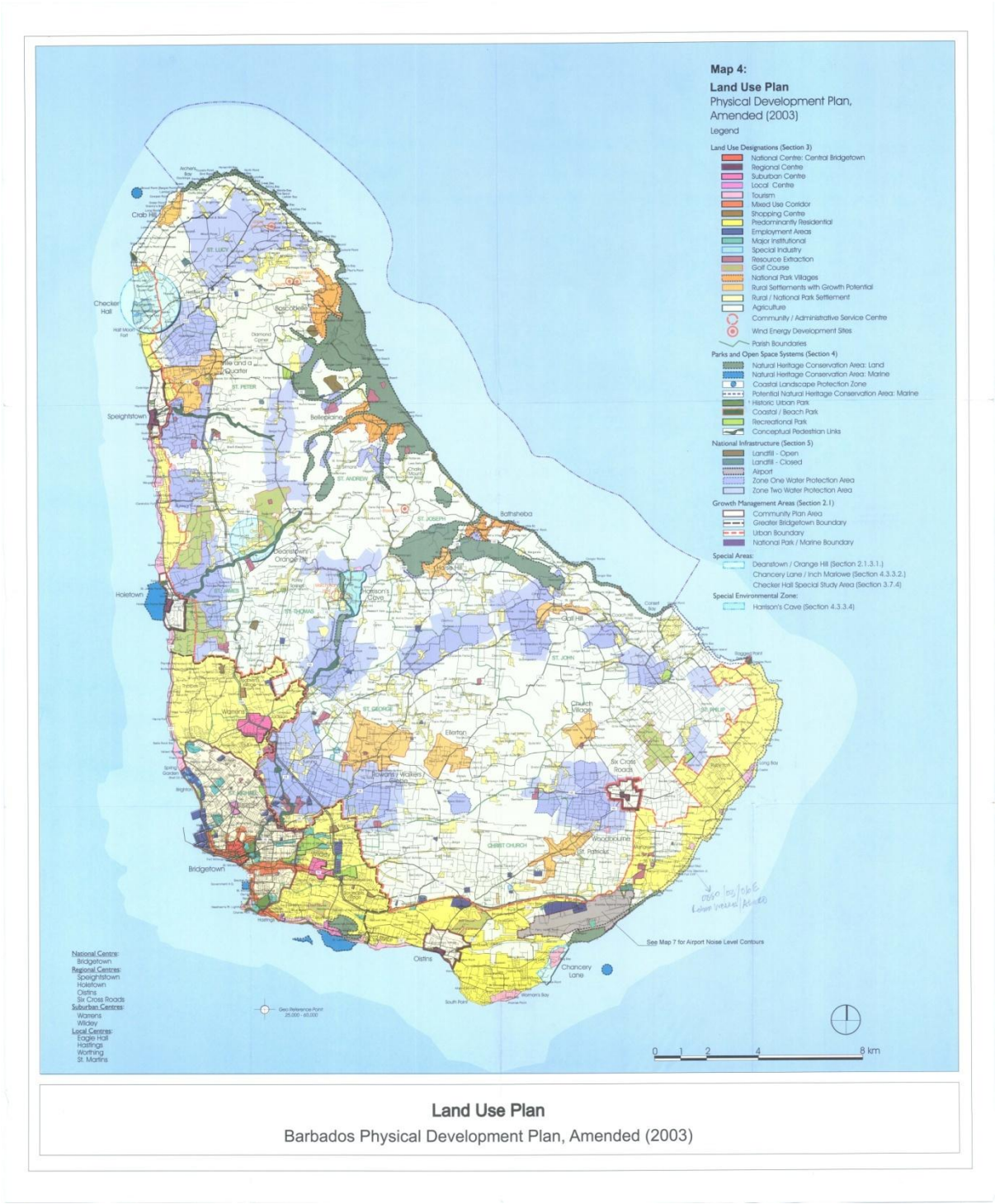

Figure 10: Land use Plan for Barbados as Described in the Barbados Physical Development Plan, Amended 2003

The urban corridor lies along the west, south and south-east coasts of the island. According to the Barbados Physical Development Plan 1986 the national population in 1980 was 247, 129. It also estimated that some 152,000 persons or 62% of the national population resided in the urban belt. While the current PDP amended 2003 does not state the size of the urban population, it projects that the national population of 268,792 in 2000 would increase to 274, 200 in 2010. Between 1970 and 2000 the population increased by 36,465 or 0.39%. The increase in population over time has tended to exert pressure on the available agricultural

lands and country side. The boundary to the current PDP (Amended 2003) was expanded in selected areas to provide additional space for urban residential development.

Another factor which contributes to habitat loss and fragmentation is the clearance of land for agricultural purposes. While this was a major problem historically, in more recent years vegetation loss has resulted primarily from land clearance to facilitate urban development. Habitat change resulting from land clearance for urban development, causes the irreversible damage of natural habitats and the subsequent reduction in the available foraging (e.g. fruit, flowers or insects) and nesting/roosting (e.g. trees, caves) habitats of species.

Figure 11: African green monkeys Playing on Land Cleared for Residential Development

CASE STUDY 1: GRAEME HALL SWAMP[57]

Figure 12: Cattle egret (*Bubulcus ibis*) Colony in the Graeme Hall Swamp

The Graeme Hall Swamp is the largest remaining wetland in Barbados and is the country's lone Ramsar site. The swamp which covers an area of 32 ha, is a naturally created coastal wetland area with mangrove forests which includes a 12-acre artificially-created lake that constitutes the largest body of inland water on the island. Graeme Hall Swamp is an important ecosystem to Barbados but occurs in one of the most densely populated areas of the island and is under considerable pressure from developments in the surrounding areas. The issues related to the management of Graeme Hall Swamp Ecosystem continue to be addressed by a plethora of government ministries and departments: for example the Drainage Unit is responsible for issues related flood mitigation, the Ministry of Health for vector control, the Ministry of Agriculture engages in activities in sections of the ecosystem and the Ministry of Environment and Drainage for issues related to water quality, biodiversity conservation and management.

In an effort to move towards effective coordination, the Director, Natural Heritage Department convened the Graeme Hall Ecosystem Management Committee, comprising representatives of the Ministry of Environment, Water Resources and Drainage, the Coastal Zone Management Unit, Environmental Protection Department, Drainage Department and the Barbados Water Authority, to address the issues related to the effective management of the ecosystem.

5.5.1.2 ALIEN INVASIVE SPECIES

The introduction of alien invasive species is a major environmental and natural resource concern for Barbados. These species are introduced into the local ecosystem by a number of means, including, *inter alia*, marine and air transport; atmospheric transport such as the Sahara dust plumes which usually cross the Atlantic from the African continent and through smuggling as pets. Alien invasive species in Barbados have successfully preyed upon, competed against and altered the habitats of indigenous species and as a result, have had severe negative impacts not only on native species but also on the agricultural sector. This

[57] Government of Barbados, Ministry of the Environment, Water Resources and Drainage, 2009. *Economic and Social Report of the Ministry of the Environment Water Resources and Drainage*

has resulted in considerable economic losses through crop damage and the diversion of scarce revenue to support eradication programmes.

Species such as The Giant African Snail (*Achatina fulica*) a native of the East African coastal region which was observed in 2000[58], the Pink hibiscus mealybug, Papaya mealybug, West Indian fruitfly, Citrus leafminer, Asian citrus psylla, C*ycad aulacapsis* scale and Chilli thrips[59] have all been a financial burden, costing the country hundreds of thousands of dollars thus far as a result of crop damage and the amounts of money spent in eradication programmes. A greater level of resources is now required to adequately address the issue of invasive species in Barbados. Work is continuously being done in the scientific and technical arenas in Barbados to develop solutions for the eradication and/or effective management of alien invasive species.

Figure 13: Ministry of Agriculture's Giant African Snail (*Achantina fulica*) Bounty Programme Poster

[58] Ministry of Agriculture, September 2004 at www.agriculture.gov.bb

[59] Government of Barbados, National Report to The United Nations Commission for Sustainable Development (UNCSD) Cycle 16/17 (2008/2009), Agriculture, Desertification and Land Degradation, Drought, Land, Rural Development and Reporting on Johannesburg Plan of Implementation Target on Integrated Water Resources Management and Water Efficiency Plans, Environment Division, Ministry of the Environment, Water Resources and Drainage, March 31st 2009.

CASE STUDY 2: THE GIANT AFRICAN IN BARBADOS[60]

Giant African Snail (Achantina fulica)

The Giant African Snail (Achantina fulica) was first reported in Barbados in 2000 in the city of Bridgetown and spread quickly to small pocket areas where they proliferated. The snails were then transported deliberately or accidentally by persons as they travelled and /or traded in goods e.g. agricultural produce, soil, lumber, machinery across the country. The snail's high fecundity and effective dispersal through human travel has contributed to the rapid increase in population size and subsequent spread across the country. The snail is now well established in Barbados. Some research has been done at the local level in an effort to assist in the development of strategies to manage this pervasive pest. Since its introduction the Ministry of Agriculture established a hotline for persons to call and report sightings, this activity would help the Ministry to track the spread of the snail across the island, an island wide baiting programme was established and members of the public were encouraged to visit the Ministry to collect bait. A media campaign was also employed to inform the public about the snail e.g. how to identify the species, feeding habits etc. and encouraged members of the public to kill the snails whenever seen by crushing them, using bait pellets containing the chemical Methaldehyde, burning and immersing in salt water or water containing bleach. The Ministry of Agriculture has also instituted a bounty on the snail, where persons are paid 50 cents (US 25 cents) per pound for snails collected. It has been deemed too late to effect the eradication of the Giant African snail and the focus has shifted to the control of the pest primarily through the methods already being employed by the Ministry of Agriculture .For these to be effective all individuals and businesses must play their part in the process as Barbados continues to grapple with the control of the Giant African snail.

5.5.1.3 OVERHARVESTING

Overharvesting of marine and terrestrial resources is an issue of concern for Barbados. However, overharvesting of marine biodiversity has occurred on a significantly larger scale than overharvesting of terrestrial biodiversity. Overharvesting, especially of the marine resource has the potential to have significant negative impacts on the social, environmental and economic landscape of Barbados. The decreases in some fish and sea urchin (*Tripneustes ventricosus*) populations as well as decreases in the average sizes of species for example reef fish have been as a result of overharvesting over the years. The Fisheries Management Plan was developed by the Fisheries Division of the Ministry of Agriculture and Rural Development as a management tool ultimately aimed at managing the island's fishery resources sustainably[61] (and this would include addressing the issue of overharvesting) as well as providing protection to the coral reefs.[62].

[60] Fields, A, Gibbs, I., Taylor, B., 2006, 'Colonization of Barbados by the Giant African Snail, *Achatina* fulica, Bowdich 1822, *Journal of the Barbados Museum and Historical Society LII 233-241*

[61] Fisheries Division, Ministry of Agriculture and Rural Development, '*Barbados Fisheries Management Plan 2004-2006*',Schemes for the Management of Fisheries in the Waters of Barbados.

[62] Government of Barbados, 2002, National Biodiversity Strategy and Action Plan

CASE STUDY 3: SEA EGG OVER EXPLOITATION MANAGEMENT STRATEGY[63]

White Sea Urchin (Tripneustes ventricosus)

The White sea urchin (Tripneustes ventricosus), supports commercial small scale fisheries in Barbados. Commercial sea egg fishing has been an integral part of the fisheries sector in Barbados for over one hundred years. The adults are harvested and the juveniles are left to replenish stocks for the following year. In Barbados, the harvest period is between September and December. Generally, the allowable harvest/ open season is determined based on abundance assessments studies and predicted abundance of sea egg populations for the following year.

Stock abundance surveys, which are based on sea egg density in select index sites around the island, have shown a marked decrease in annual densities. These surveys are conducted prior to the commencement of the sea egg fishing season with collaboration of the Fisheries Division of the Ministry of Agriculture, fisherfolk and the BARNUFO. The results are then used to help in determining the length and timing of the fishing season.

The island has noted a decrease in sea egg numbers over the years, mainly due to over exploitation. In response to decreasing sea egg stocks, Barbados has developed a number of strategies to arrest the decline in numbers and increase overall population density.
Barbados' Sea Egg Management Strategy: Timeline

1879 Sea egg Preservation Act 1879 – prohibited harvesting between May – August during peak of breeding season.

1904 Fisheries Regulation Act –annual closed season to be Gazetted & more severe penalties for violations of provisions in the Act. Closed season May – August.

1986 Collapse of the Sea Egg Fisheries due mainly to overfishing. 2 year moratorium from September 1987 – August 1989 including monitoring of sub-populations.

1989 Moratorium lifted in September. New closed season from January – August of each year.

1994 Change in management strategy. Duration and timing of the closed season to be determined in response to an assessed and predicted abundance of populations for the coming season. Co-management strategy put in place.

1998 3 year moratorium from August 1, 1998 to July 31, 2001. This period was extended to the end of September 2001 and the open season declared for 2 months from October – November, 2001.

1997 – Barbados Fisheries Management Plan 2004 – 2006. Section 5.4 addresses the sea egg fishery including ecology, economics, status, management. E co-management approach for the management of sea egg population is defined in the document.

1998 CZMU - Coastal Zone Development project which looked at further defining the co-management approach

In spite of these management strategies sea egg numbers have not increased as anticipated. The main reasons for the decrease in the numbers include persistent illegal fishing, high levels of effort during open season, inefficient enforcement and lack of compliance as well as a general reluctance by the judicial system to treat contravention of the fisheries regulations as a serious offence.

[63] a) McConney, P., M. Pena. 2005. Summary of events in the 2004 Barbados sea egg fishing season (15-30 September, 2004). Centre for Resource Management and Environmental Studies (CERMES), Faculty of Pure and Applied Sciences, University of the West Indies (UWI), Cave Hill Campus, Barbados. 17pp.
(b) McConney, P and M. Pena. 2004. Events and Institutional Arrangements in the Management of the 2003 Barbados Sea Egg Fisheries Season (15 September – 15 October). Coastal Resources Co-Management Project (CORE-COMP). Centre for Resource Management and Environmental Studies (CERMES), Faculty of Pure and Applied Sciences, University of the West Indies (UWI), Cave Hill Campus, Barbados. 38pp.

5.5.1.4 POLLUTION

Marine pollution is one of the major threats to marine biodiversity. Eutrophication caused by terrestrial run off containing a combination of sewage and fertilizer from pesticide use is thought to be the primary cause of coral reef degradation in Barbados. Coral reef degradation is a major concern for the country since its economic, environmental and social well being heavily depends on the health and functioning of the marine ecosystem.

In addition, Litter and marine debris can also negatively impact coastal biodiversity for example, the contamination of nesting beaches of marine turtles by oceanic debris and discarded fishing gear has sometimes resulted in entanglement.

5.5.1.5 UNREGULATED SHOOTING OF BIRDS

The hunting of migratory shorebirds in "shooting swamps" in Barbados has existed since the colonial era and remains a practice of a minority group. The Ministry of the Environment is aware of the issue and has taken steps to gather information on the practice through annual surveys and consultation with individuals involved in the activity. It was anticipated that this information would be used to develop policies that would effectively address this matter. Efforts continue to monitor and regulate this activity.

CASE STUDY 4: THE CONSERVATION OF A SHOOTING SWAMP TO A BIRD RESERVE[64]

Woodbourne Shorebird Reserve (WSR)

The Government of Barbados through the Ministry of the Environment has over the years conducted site visits and collected information on an annual basis as part of its hooting swamp monitoring programme. In addition, BirdLife International has been working with the hunters over the years to try to change their attitudes from the hunting of birds for sport towards conservation. Some hunters have agreed to maintain artificial wetlands year-round as opposed to only during hunting season in an effort to provide valuable habitats for shorebirds and other waterbirds. In its continued effort, the Barbados Wild Fowlers Association has also agreed to standardize and compile data on the annual harvest of shorebirds in an effort to assist with the implementation of appropriate bag limits.

In 2009 two former hunters were instrumental in securing a lease for 10 acres of land in Woodbourne, St. Philip, which was formerly used as a shooting swamp and in financing the initial restoration of the area as a wetland. The area is now called the Woodbourne Shorebird Refuge and many current and former hunters have been contributing to its success through offering advice and donating equipment. Since its restoration, 20 species of shorebirds have been recorded in the refuge. The refuge receives daily visits from local and visitors alike and is used for educational and awareness purposes to teach persons about the importance and value of freshwater ecosystems and birds to the environment. It is anticipated that the success of the Woodbourne project will be replicated at other abandoned shooting swamps across the island and that this, together with the inculcation of a more responsible hunting ethic , collection of shooting data, implementation of bag limits and an effective monitoring and enforcement regulatory regime to manage the process will assist in the enhanced conservation of migratory species in Barbados.

[64] www.woodbournebarbados.org

5.5.1.6 NATURAL RESOURCE EXTRACTION

Resource extraction (quarrying and sand mining) is generally regarded as a national economic necessity in the context of the island's relatively scarce terrestrial natural resource supply. In this regard, these operations need to be continuously monitored and strictly managed to ensure that potential negative impacts such as soil erosion, flooding in coastal areas and the degradation of terrestrial and marine habitats are minimized

5.5.1.7 NATURAL HAZARDS/ DISASTERS

The primary natural hazards which affect Barbados are storms/hurricanes, periodic flooding and land slippage. Other events which have affected the island include fire and an earth tremor in 2007. There are no known studies on the impacts of biodiversity after the country has experienced a hazard or a natural disaster, but it is expected that such events will negatively impact on species through mortality, habitat degradation or destruction and reduce food supplies.

Sea level rise and global warming can also affect how natural disasters impact coastal biodiversity. Barbados, like the other Small Island Developing States (SIDS) and Low Lying Coastal States (LLCS), will be at the forefront of the impacts resulting from the adverse effects of climate change. Therefore, a major challenge will be how to plan for, adapt to and mitigate the adverse impact of global climate change on local biodiversity and its associated implications. Furthermore, the country's small size will undermine its ability to absorb the shock caused by natural disasters[65] of the magnitude anticipated as a result of climate change. It is therefore critical that the country integrates biodiversity considerations into its planning processes as it continues to move toward planning for the adverse impacts of climate change.

[65] Comprehensive Report to Inform the Presentation by the Government of Barbados to the Annual Ministerial Review of the United Nations Economic & Social Council on Barbados' Progress Towards Achieving the Millenium Development Goals & the Other Internationally Agreed Development Goals, 2007

Table 3: Threats to Biodiversity in Barbados and Implications of Biodiversity Loss

Biome/ Ecosystem Type	Threats	Drivers of Threats		Implications
		Direct Drivers	**Indirect Drivers**	
Terrestrial	Land development Grass, pasture, sugarcane fires Introduction of invasive species Agri-chemical use Excessive land clearing Climate change	Pollution Habitat change, loss, destruction Alien invasive species	Unsustainable patterns of consumption & production Population growth & distribution Market failure	Habitat loss Loss of species – endemic, endangered Ecosystem fragmentation Loss of ecosystem benefits Pollution of fresh water systems Soil erosion Food insecurity
Marine & Coastal	Pollution Coastal land development Agricultural activities Over fishing Climate change	Over exploitation Pollution Sea level rise Human activities – damage to reefs	Unsustainable patterns of consumption & production Population growth & distribution Market failure Improvements to fishing catch technologies	Loss & degradation of habitats Loss of ecosystem benefits Food insecurity Species loss
Freshwater	Climate change Pollution Land development Alien invasive species	Habitat change Reduced annual rainfall	Unsustainable patterns of consumption & production Population growth & distribution Market failure	Habitat loss – ponds, mangroves, catchment areas Reduced quality of fresh water for human consumption Loss of ecosystem benefits
Agriculture	Land development Pollution Alien invasive species Climate change New varieties	Habitat change Invasive species – e.g. Giant African Snail	Unsustainable patterns of consumption & production Population growth & distribution Market failure	Loss of indigenous germplasm – loss of diversity Loss of species Loss of ecosystem benefits

				Pollution of ground water & marine ecosystems
Biome/ Ecosystem Type	**Threats**	**Drivers of Threats**		**Implications**
		Direct Drivers	**Indirect Drivers**	
Terrestrial	Land development Grass, pasture, sugarcane fires Introduction of invasive species Agri-chemical use Excessive land clearing Climate change	Pollution Habitat change	Unsustainable patterns of consumption & production Population growth & distribution Market failure	Habitat loss Loss of species – endemic, endangered Ecosystem fragmentation Loss of ecosystem benefits Pollution of fresh water systems Soil erosion Food insecurity
Marine & Coastal	Pollution Coastal land development Agricultural activities Over fishing Climate change	Over exploitation Pollution Sea level rise Human activities – damage to reefs	Unsustainable patterns of consumption & production Population growth & distribution Market failure Improvements to fishing catch technologies	Loss & degradation of habitats Loss of ecosystem benefits Food insecurity Species loss
Freshwater	Climate change Pollution Land development Alien invasive species	Habitat change Reduced annual rainfall	Unsustainable patterns of consumption & production Population growth & distribution Market failure	Habitat loss – ponds, mangroves, catchment areas Reduced quality of fresh water for human consumption Loss of ecosystem benefits
Agriculture	Land development Pollution	Habitat change Invasive	Unsustainable patterns of consumption & production Population growth &	Loss of indigenous germplasm – loss of diversity

	Alien invasive species Climate change New varieties	species – e.g. Giant African Snail	distribution Market failure	Loss of species Loss of ecosystem benefits Pollution of ground water & marine ecosystems

5.5.2 IMPLICATIONS OF BIODIVERSITY LOSS

Biodiversity loss will have serious negative implications for the social, economic and environmental well being of Barbados if not monitored and controlled. Natural resources provide essential services such as prevention of land degradation/soil erosion, prevention of coastal erosion, pollination of crops, provision of clean air and water, nutrient cycling, provision of medicinal plants, provision of food and shelter. Biodiversity also has cultural, aesthetic and spiritual benefits. Barbados' economy depends on biodiversity for its stability, valuable industries such as agriculture and tourism would be significantly impacted by the loss of biodiversity.

In an effort to address and minimize the negative impacts of the various biodiversity threats previously highlighted, the Government of Barbados, academia, private sector, non-governmental and community based organizations have been working together to develop, implement and execute various policies, plans and programmes in this regard. Further, a significant amount of resources have also been targeted at increasing public education and awareness about the value of biodiversity and the importance of biodiversity conservation. A synopsis of biodiversity's importance to Biodiversity is shown in Appendix VI.

6 CURRENT STATUS OF THE NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN

6.1 INTRODUCTION

The proceeding chapter details the implementation of the National Biodiversity Strategy and Action Plan, the supporting national policy and legislative framework for biodiversity management and how this supporting framework is linked to the country's progress towards the implementation of the NBSAP. Funding priority activities and the overall effectiveness of the NBSAP are also discussed.

6.2 POLICY AND LEGISLATIVE FRAMEWORK

The Ministry of Environment and Drainage is the focal point for biodiversity conservation as well as for all environment and protected areas related matters. Biodiversity management in Barbados involves a multidisciplinary approach by several agencies that include government Ministries, NGOs, CBOs, academia, the private sector, regional and international organizations. These agencies share responsibility for implementing policies, programmes and projects that directly or indirectly contribute to biodiversity conservation and management.

These various agencies and institutions have their own legislative mandates, administrative procedures, resources, work programmes and priorities. There has been a significant improvement as it relates to the sharing of information among these entities about projects being undertaken to coordinate, facilitate and support biodiversity conservation and management work in general. They also recognize the need for a coordinated and integrated approach to biodiversity management and consistently work toward this goal.

The main partners are the Agencies and Departments within the MED, other Government Ministries e.g. the Ministry of Agriculture, Tourism etc, academic and research institutions e.g. the Caribbean Agricultural Research and Development Institute, West Indies Sugarcane breeding station and The University of the West Indies, Non-governmental Organizations e.g. the Barbados National Trust, the Barbados Marine Trust and the private sector e.g. dive operators, tour guides etc.

The Government has also demonstrated its commitment to biodiversity conservation through the Cabinet appointment of several multi-sectoral committees namely the Working Group on Biodiversity and the CITES Scientific Authority which all have biodiversity conservation and management as their primary mandate. There are also various other inter-sectoral committees which consider and incorporate biodiversity matters into their plans and activities.

6.2.1 INTERNATIONAL AGREEMENTS

There are several international conventions, to which Barbados is party, which make provision for some elements of the conservation and protection of biological diversity. In accordance with the provisions of these conventions, the country has the obligation to formulate appropriate rules to facilitate the preservation of biological resources. In order to

achieve the objectives of the various multilateral environmental agreements it is necessary to enact certain laws and regulations at the domestic level. These laws operationalise the global principles and goals aimed at the conservation and protection of biological diversity. In addition, the domestic laws include administrative, monitoring, enforcement and compliance provisions. The most relevant international agreements in relation to biodiversity conservation are:

- *United Nations Convention on Biological Diversity.*
- The *Convention on International Trade In Endangered Species*
- *United Nations Framework Convention on Climate Change and Kyoto Protocol*
- *United Nations Convention on the Law of the Sea*
- The *Convention for the Protection and Development of the Marine Environment of*
- *the Wider Caribbean Region (Cartagena)*, and the *Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean Region, (OILSPILL Protocol)*
- *Convention to Combat Desertification*
- *The Vienna Convention for the Protection of the Ozone Layer*
    - *the Montreal Protocol on Substances that Deplete the Ozone Layer*
- *The UN Fish Stocks Agreement*
- *FAO Compliance Agreement*
- *International Commission for the Conservation of Atlantic Tunas*
- *The Protocol (to the 1983 Cartagena Convention) Concerning Specially Protected Areas and Wildlife in the Wider Caribbean (SPAW).*

6.2.2 NATIONAL PLANS, POLICIES AND LEGISLATION

A review of Barbados' legislation shows that unlike many countries there is no existing comprehensive environmental legislation. The existing legal framework consists of a series or individual pieces of legislation enacted to address specific issues. Some of these laws, although it may not be their overarching intention, address some aspects of the conservation and protection of biological diversity. Currently there is a draft Environmental Management Act together with the following relevant pieces of legislation: The Constitution (Section 16)

- The Town and Country Planning Act Cap 240
- The Barbados Territorial Waters Act 1977 (1977-26)
- The Marine Boundaries and Jurisdiction Act 1979 cap 387
- The Fisheries Act 1993 Cap 391
- Fisheries Management Regulations 1998
- Draft Zoos Legislation
- The Marine Pollution Control Act Cap 392A
- The Coastal Zone Management Act (1998-39)
- National Conservation Commission Act 1982 cap 393
- Wild Birds Protection Act Cap 398
- Protection of New Plant Varieties Act (2000-17)
- The Soil Conservation (Scotland District) Act cap 396
- Trees (Preservation) Act cap 397
- The Cultivation of Trees Act Cap 390
- The Caves Act Cap 389
- Land Acquisition Act cap 228

- The Barbados Agricultural Development and marketing Corporation Act (12/1998)
- The Animals (disease and Importation) Act cap 253
- Underground Water Control Act Cap 283
- The International Trade in Endangered Species of Wild Fauna and Flora Act, 2006-3

The Draft Environmental Management Act for Barbados contains provisions for the implementation of the CBD and the SPAW Protocol and will serve as the enabling legislation for the National Park Plan. It makes provision for designation of specially protected areas, including the Scotland District and coastal planning areas. The Draft legislation also covers several subjects such as:

- Implementation of biodiversity conventions
- Integrated environmental management
- Conservation of natural heritage resources, flora and fauna
- Protection of cultural knowledge
- Prohibition and regulation of discharges into the environment
- Enforcement procedures
- Regulation of waste management and waste disposal operations
- Provision for environmental impact assessment
- Establishment of regime for the protection of forestry and arboriculture
- Wildlife protection
- Pollution control
- Regulation of toxic substances and pesticides

The proposed Barbados National Parks Act builds upon the existing legislative framework. The proposed Act includes the following:

- The description of the area to be included in the National Park
- The creation of the post for a Director of the Barbados National Park
- The Constitution of a National Park Advisory Board
- The creation of a Barbados National Park Plan and;
- A number of procedures for notification and consultation with other relevant agencies

The enactment and enforcement of the Environmental Management Act and the National Parks Act and supporting legislation will provide the platform to effect behavioural changes as it relates to Biodiversity Management in Barbados.

The National Biodiversity Strategy and Action Plan (NBSAP) is one of several sectoral plans which have been prepared with a view to achieving a comprehensive framework for sustainable development of natural resources in Barbados. The other existing plans for physical development and natural resources management in Barbados are:

- The Physical Development Plan (PDP), Amended 2003
- The Fisheries Management Plan (FMP) 2006 and Draft 2008-2011
- The Environmental Management and Natural Resources Management Plan (EMNRMP)
- Two area specific plans to accompany the EMNRMP: the National Park Development Plan and the Coastal Zone Management Plan
- The National Strategic Plan of Barbados2006-2025
- Medium Term Development Strategy 2010 - 2014

- The Sustainable Development Policy, 2004
- Barbados Gully Ecosystem Management Study 2004
- The Scotland District Development Study 1979
- Draft Beach Management Plan 2007

These plans make provisions for the sustainable management of the majority of the human activities that impact on the conservation of biodiversity in both the marine and terrestrial environment. In accordance with the CBD, the NBSAP integrates biodiversity management and conservation into these sectoral plans and tries to minimize overlap and increase the efficiency of use of human, financial and equipment resources.

6.2.3 OVERVIEW OF THE NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN

The National Biodiversity Strategy and Action Plan (NBSAP) for Barbados was published by the Ministry of Physical Development and Environment now the MED in July 2002. The NBSAP presents an overall goal for biodiversity management and identifies specific objectives and affiliated strategies and actions which should be applied to the various components of biodiversity described in the Biodiversity Country Study Technical Reports (Environmental Management and Land Use Planning for Sustainable Development 1998), i.e. Natural Vegetation, Agriculture, Land Resources, Terrestrial Fauna, and Marine and Freshwater species. The specific objectives outlined in the Plan are as follows:

1. To mobilize adequate financial resources for the management and conservation of Barbados' biodiversity.

2. To develop the human resource base and strengthen institutional capacity for biodiversity conservation and management

3. To conduct essential research to inform the development and implementation of management practices for the sustainable use of biodiversity

4. To use the results of the Research Programme to develop appropriate management techniques and mechanisms to ensure sustainable consumptive use and to preserve non-consumptive use values of biodiversity resources

5. To revise, consolidate and formulate policy and legislation to achieve the conservation and sustainable use of biodiversity

6. To promote biodiversity conservation and sustainable use through incentives

7. To incorporate conservation requirements into land-use planning

8. To improve public awareness and education

9. To establish effective in situ and ex situ biodiversity conservation measures

10. To ensure equitable biodiversity and traditional knowledge access and benefit sharing

11. To establish biosafety regulations in order to safeguard biodiversity

12. To promote the conservation and sustainable use of biodiversity in various sectors (agriculture, health, fisheries, tourism)

The NBSAP was developed in consultation with various stakeholders and it identifies threats and constraints to biodiversity conservation. Taking cognizance of the existing legislations, implementation mechanisms, strategies, plans and programmes, specific action points have been proposed that will result in the integration of biodiversity concerns into various other sectors. The challenge has been to make the NBSAP consistent with the ecological, social, cultural and economic objectives of the country. It is also desirable for the NBSAP to be the national focus and impetus towards biodiversity conservation. The NBSAP also provides information for the implementation of key activities and associated strategies to improve conservation of biodiversity in Barbados. This chapter highlights the current status of national policies, plans, strategies, and legislations relevant to the CBD. It also provides information on the progress of implementation of the action points listed in the NBSAP.

6.2.4 INCORPORATION OF CBD TARGETS AND INDICATORS INTO THE NBSAP

In recognition of the crucial importance of benchmarks and indicators to the achievement of overall sustainable development at the national level, the Government of Barbados has identified a number of indicators to demonstrate, monitor and evaluate the country's progress towards a 'Green Economy' and ultimately sustainability of which biodiversity management will play a crucial role. Indicators have been identified through a National Indicators Programme to cover the areas of environment, economic, development and social welfare. The environmental indicators identified have been categorised into various themes Air, Land Use and Water. The specific indicators identified for biodiversity are as follows:

- Local species populations (terrestrial and marine)
- Threatened species as a percentage of total native species
- Percentage change in key ecosystems (reefs, seagrass beds and mangroves)
- Decline of indicator species as a measure of habitat stability and health (non-coastal)
- Quantity of introduced/exotic species

These indicators have been incorporated into the NBSAP at varying levels of detail. A large number of local terrestrial and marine species have been described as well as the quantity of introduced / exotic species. However, the decline of indicator species as a measure of habitat stability has not been measured. The progression of the National Indicators programme has been challenged by financial constraints over the years. However, there are some pockets of work being advanced by satellite agencies of the MED.[66] Table 4 highlights the incorporation of CBD targets and indicators into the NBSAP.

[66] http://www.un.org/esa/dsd/dsd_aofw_ind/ind_natiacti_barbados.shtml

Table 4: Incorporation of CBD Targets into the NBSAP

Goal No.	CBD Goal	Corresponding NBSAP Objective
1	**Promote the conservation of the biological diversity of ecosystems, habitats and biomes.**	Objective 1: To mobilise adequate financial resources for the management and conservation of Barbados' biodiversity Strategy 1: Develop mechanisms for funding the conservation and management of biodiversity, ensuring that the costs of protection are equitably shared Objective 6 : To promote biodiversity conservation and sustainable use through incentives Objective 8: To improve public awareness and education Strategy 1 : includes the strategy to develop public awareness through educational and training activities to ensure broad based support and involvement in biodiversity conservation Objective 12 : To promote the conservation and sustainable use of biodiversity in various sectors (agriculture, health, fisheries and tourism)
2	**Promote the conservation of species diversity**	No quantitative target has been developed in relation to this goal it is being addressed under the NBSAP as well as other sectoral plans. Objective 3: To conduct essential research to inform the development and implementation of management practices for the sustainable use of biodiversity Strategy 1: Establish a National Research programme to document the status of, threats to and value of biodiversity Objective 4: To use the results of the Research Programme to develop appropriate management techniques and mechanisms to ensure sustainable consumption use, and to preserve non-consumptive use value of biodiversity resources Strategy 2: Develop management approaches for conservation of species and ecosystems that have

		significant non-consumptive use value, for example, for tourism or for ecological services provided Actions: Develop taxon-specific management plans to protect species of significant non-consumptive use value e.g. insectivorous and frugivorous bats, snakes, reef fish, sea turtles inter alia (H) Objective 12 : To promote the conservation and sustainable use of biodiversity in various sectors (agriculture, health, fisheries and tourism) The Integrated Gully Ecosystem Management Plan provides the following Biodiversity management Guidelines: • Forested gullies in which the majority of individual trees are native species should be protected from development. Extraction of fauna and flora from these gullies should be controlled • Gullies containing restricted range, rare species should be protected from development, inappropriate use, and from collection or extraction of fauna and flora for either personal or commercial purposes. Exceptions should only be made in respect of captive breeding or propagation for non-commercial purposes and for scientific research. • Strict enforcement of a 3 metre buffer zone which prohibits the clearing of any vegetation from the gully lip • Encouragement of the use of native species for landscaping gully sections and exotic plants (excluding invasive species) should be used sparingly • Introduction of known invasive species to gullies should be prohibited • Only minimal clearing of vegetation, including undergrowth, should in the establishment of infrastructural projects • The negative impacts (increased run-off, introduction of exotic and invasive species, increased light and noise, etc) of development on lands adjoining gullies should be minimized • To avoid impacts from invasive species only exotic plants that are not easily propagated should be planted on the edge or within gullies Objective 12 (Agriculture**):** of the NBSAP encourages agricultural biodiversity conservation and sustainable use by revising approaches towards agricultural management. The following actions have been recommended: • Develop an official mechanism for collaboration with the Ministry of Agriculture and Rural Development with respect to the conservation and sustainable use of agro-biodiversity

		• Promote knowledge in the farming community of the economic value of biologically diverse farms promoting soil conservation, biological pest control, application of organic fertilizers and reduction in agro-chemicals • Development of Organic Farm Management Programme including standards, certification, etc. • Establishment of a national Integrated Pest Management Programme • Establishment of a national Plant and Quarantine Programme • Regulate and restrict the use of herbicides and pesticides that result in biodiversity loss • Establish a national programme to preserve germplasm of particular species Objective 12 (Health**):** of the NBSAP requires the incorporation of biodiversity conservation issues into disease control and waste management practices. The following actions have been recommended: • Review existing management strategies for mosquito and rodent control in relation to harmful impacts on-target species and sensitive ecosystems • Increase regulation of pesticide use • Promote natural biological control disease vectors • Strengthen laws governing solid waste management • Support recycling schemes • Ensure proper buffering of solid waste and hazardous waste disposal sites Objective 12 (Fisheries): of the NBSAP encourages fisheries conservation and sustainable use by revising approaches towards fisheries management. The following actions have been recommended: • Ensure that important breeding grounds are protected within Natural Heritage Conservation Areas • Improve coordination and collaboration with relevant stakeholders • Regulate fishing apparatus and methods to reduce adverse effects on marine biodiversity • Reduce at sea dumping of garbage and discarded fishing gear • Improve training and education for all stakeholders; monitoring and enforcement, and research Objective 12 (Tourism**):** of the NBSAP encourages the adoption of measures to reduce threats to biodiversity resulting from improperly planned and managed tourism development. The following actions

		have been recommended: • Undertake research to determine the impact of tourism sector on biodiversity loss • Encourage sound environmental management techniques at existing tourism facilities, e.g environmental management systems • Promote appropriate regulatory and pricing mechanisms to ensure compliance with carrying capacities of sensitive ecosystems • Prevent high impact tourism development from sensitive environments Objective 10.2 of the Barbados Sustainable Tourism Policy contains the specific objective which aims to promote sustainable tourism development through the protection, conservation and development of the natural environment within its carrying capacity and through education and awareness of, and respect for, our unique natural heritage. The Sustainable Tourism Policy calls for the following actions to: • Determine the carrying capacity and encourage the development of a mechanism for the economic valuation of the natural resource base sites and supporting infrastructure which form Barbados tourism product. • Support and encourage the development and management of special conservation areas • Facilitate the conduct of an assessment of the impact of the tourism industry on the natural environment • Encourage the protection of the limited natural resources base and promote the philosophy of carrying capacity in the tourism development process
3	**Promote the conservation of genetic diversity**	Objective 9 of the NBSAP seeks to establish effective *in situ* and *ex situ* biodiversity conservation measures. Strategy 2: • Identification of species of fauna and flora requiring *ex situ* conservation measures • Establish or provide support for captive breeding facilities/plant nurseries/arboreta of support existing facilities for appropriate threatened species • Manage and control the collection of biological resources from natural habitats for *ex situ*

		conservation Objective 12 seeks to promote the conservation and sustainable use of biodiversity in various sectors (agriculture, health, fisheries and tourism). Strategy 1: (Agriculture): Encourage agricultural biodiversity conservation and sustainable use by revising approaches towards agricultural management Action: Establish a national programme to preserve germplasm from the Barbados black belly sheep (either by storing the frozen semen or storing fertilized eggs) The Integrated Gully Ecosystem Management Plan (IGEMP) makes provision for the following: 1. Develop island-wide policies for gully reforestation and protection, including: • A policy to promote the ongoing natural reforestation • Prohibition of removal of trees and shrubs in gullies 2.Establish a series of conservation/recreation areas that would protect representative gully habitats while making them accessible for recreation and education

4	**Promote sustainable use and consumption**	Objective 3: To conduct essential research to inform the development and implementation of management practices for the sustainable use of biodiversity some of the actions outlined under Strategy 1 are: to assess the economic value of consumptive use of biodiversity resources and undertake a preliminary assessment of the non-consumptive value of biodiversity on the island Objective 4: To use the results of the Research Programme to develop appropriate management techniques and mechanisms to ensure sustainable consumption use, and to preserve non-consumptive use value of biodiversity resources Strategy 1: Develop management approaches for the sustainable consumptive use of flora and fauna Strategy 2: Develop management approaches for conservation of species and ecosystems that have significant non-consumptive use value, for example, for tourism or for ecological services provided Objective 5: To revise, consolidate and formulate policy and legislation to achieve the conservation and sustainable use of biodiversity. Objective 6: To promote biodiversity conservation and sustainable use through incentives Objective 8: To improve public awareness and education
	Pressures from habitat loss, land use change and degradation, and unsustainable water use, reduced	Objective 3: To conduct essential research to inform the development and implementation of management practices for the sustainable use of biodiversity Strategy 1: Establish a National Research programme to document the status of, threats to and value of biodiversity specifies Action item (f) Adoption of the biodiversity indicators under the National Indicators Programme as well as the identification of additional potential indicators that can be used to highlight biodiversity degradation Objective 4: To use the results of the Research Programme to develop appropriate management techniques and mechanisms to ensure sustainable consumption use, and to preserve non-consumptive use value of biodiversity resources Objective 5: To revise, consolidate and formulate policy and legislation to achieve the conservation and

		sustainable use of biodiversity Strategy 1: Implement existing national legislation and revise or develop new legislation to incorporate biodiversity management policies that are not currently adequately addressed. One of the actions identified under this strategy is to ensure the incorporation of biodiversity concerns in all Environmental Impact Assessments (EIA) Objective 7: To incorporate biodiversity conservation requirements into land use planning Strategy 1: Rationalize land use designation and encourage sectoral planning for environmentally friendly development
6	**Control threats from invasive alien species**	Objective 3: To conduct essential research to inform the development and implementation of management practices for the sustainable use of biodiversity Strategy 1: Establish a National Research programme to document the status of, threats to and value of biodiversity. The specific action identified is Prepare and implement a prioritized programme on biodiversity research, incorporating appropriate governmental and non-governmental agencies, students and staff of UWI, polytechnics and colleges, schools, communities and user groups in appropriate elements of the programme. The programme will include the following research and monitoring elements that will include inter alia • Research on the presence, distribution and abundance of alien and genetically modified species and the development of a GIS compatible database; and • Development/support of monitoring projects designed to assess impacts of exploitation, habitat loss, pollutants and alien species on the distribution and abundance of terrestrial, marine and freshwater biodiversity, alien, indigenous and rare species Objective 4: To use the results of the Research Programme to develop appropriate management techniques and mechanisms to ensure sustainable consumption use, and to preserve non-consumptive use value of biodiversity resources Strategy 1: Develop management approaches for the sustainable consumptive use of flora and fauna. This specifies the action item of developing management approaches to control alien species where studies have shown demonstrable negative impacts on indigenous biodiversity. These may include mongoose, cane toads, cattle egrets, Casuarina, water hyacinth, inter alia. Ensure adequate legal protection for critical habitats of key species and important ecosystems

		Objective 9: To establish effective in situ and ex situ biodiversity conservation measures Strategy 1: Establish an effective and sustainable system of protected areas Action: Develop and implement ecosystem rehabilitation activities and recovery plans such as the removal of alien species and replacement with indigenous species
7	**Address challenges to biodiversity from climate change and pollution**	*Climate Change* Objective 3: To conduct essential research to inform the development and implementation of management practices for the sustainable use of biodiversity Strategy 1: Establish a National Research programme to document the status of, threats to and value of biodiversity Action: Prepare and implement a prioritized programme on biodiversity research, incorporating appropriate governmental and non-governmental agencies, students and staff of UWI, polytechnics and colleges, schools, communities and user groups in appropriate elements of the programme. The programme will include the following research and monitoring elements that include *inter alia*: • Assessment of the effects of climate change on biodiversity conservation and management Objective 12: To promote the conservation and sustainable use of biodiversity in various sectors (agriculture, health, fisheries and tourism) Strategy 3 (Fisheries): Encourage fisheries conservation and sustainable use by revising approaches towards fisheries management Action: The development and implementation of a consistent monitoring and surveillance programme to scrutinize and document information on the influence that climate change has on the life-cycles of the local fish stocks. Barbados has prepared its First National Communication Report to the UNFCCC which identifies possible impacts on biodiversity. It also identifies possible linkages with other MEAs such as the CBD.

		Pollution Objective 5: To revise, consolidate and formulate policy and legislation to achieve the conservation and sustainable use of biodiversity Strategy 1: Implement existing national legislation and revise or develop new legislation to incorporate biodiversity management policies that are not currently adequately addressed Action: Strengthen the enforcement of the Marine Pollution Control Act Cap 392 to reduce marine and freshwater pollution and biodiversity kills due to land based sources of pollution, and the Coastal Zone Management Act to protect important feeding and breeding grounds in the coastal zone. Formulate national legislation relating to biodiversity access and benefit sharing This target is being implemented through the NBSAP together with various sectoral plans. The NBSAP notes that surface runoff and ground water discharge play a significant role in allowing terrestrial pollutants, in the form of nutrients, suspended solids and sewage, to enter the marine environment. Objective 12: To promote the conservation and sustainable use of biodiversity in various sectors (agriculture, health, fisheries and tourism) Strategy 2 (Health): Incorporate biodiversity conservation issues into disease control and waste management practices calls for the following actions: Actions: • Endorse and support the revision and enforcement of existing legislation by the Sewerage and Solid Waste Project Unit to impose significant monetary penalties for illegal dumping and littering • Design and implement a national programme to increase awareness of the value of natural habitats for wildlife to deter wide scale de-bushing, and to inform the public of the impacts of illegal dumping on terrestrial wildlife and on the marine environment, e.g. deterioration of water quality and impacts on sensitive nearshore ecosystems. entanglement of fish, sea turtles, and sea birds in plastic garbage inter alia (H) • Ensure that appropriate techniques and equipment are used to clean up illegal dumping sites to ensure minimum disturbance to natural habitats • Actively support recycling schemes through subsidies and incentives to reduce costs associated with landfill maintenance (H)

		• Ensure that solid waste and hazardous waste disposal sites are adequately buffered from sensitive ecosystems and critical habitats Strategy 3 (Fisheries): Reduce at-sea dumping of garbage and discarded fishing gear
8	**Maintain capacity of ecosystems to deliver goods and services and support livelihoods.**	Objective 4: To use the results of the Research Programme to develop appropriate management techniques and mechanisms to ensure sustainable consumption use, and to preserve non-consumptive use value of biodiversity resources Strategy 2: Develop management approaches for conservation of species and ecosystems that have significant non-consumptive use value, for example, for tourism or for ecological services provided Objective 9: To establish effective in situ and ex situ biodiversity conservation measures Strategy 1: Establish an effective and sustainable system of protected areas Actions: • Establish Natural Heritage Conservation Areas and identify National Forest Candidate sites under the revised National Physical Development Plan as measures to prevent habitat fragmentation, and to protect critical habitats of rare and endangered species in terrestrial, coastal marine and freshwater environments (H) • Establish a Park Service within the National Conservation Commission with wardens to manage the Natural Heritage Conservation Areas, National Forest Candidate Sites and to enforce park regulations. This activity will involve institutional strengthening of the NCC and a shift in emphasis from landscape beautification to habitat protection • Provide for adequate buffer zones and plan for environmentally friendly sound developments in areas bordering the protected areas • Identify degraded ecosystems for rehabilitation and restoration
9	**Maintain socio-cultural diversity of indigenous and local communities**	Objective 10: To ensure equitable biodiversity access and benefit sharing Strategy 1: Promote necessary actions to facilitate equitable biodiversity access and benefit sharing Actions: • Designate authority(ies) responsible for biodiversity and traditional knowledge access (H) • Create a database on entities involved in granting access to biodiversity and traditional knowledge • Create an inventory of local/traditional innovations and technologies • Creation of conditions and policies to facilitate equitable benefit sharing and access • Define considerations for biodiversity access, such as expectations of all parties, impacts on stakeholders, resources required, legal framework required, negotiating training, certificates of

		origin, protocols for field collection and laboratory work, patents, method of prior inform consent from local/indigenous communities involved, economic benefits (up-front payments, milestone payments, royalties), and duration and termination of access (H) Objective 5: To revise, consolidate and formulate policy and legislation to achieve the conservation and sustainable use of biodiversity Strategy 1: Implement existing national legislation and revise or develop new legislation to incorporate biodiversity management policies that are not currently adequately addressed
10	**Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources.**	Objective 5: To revise, consolidate and formulate policy and legislation to achieve the conservation and sustainable use of biodiversity Strategy 1: Implement existing national legislation and revise or develop new legislation to incorporate biodiversity management policies that are not currently adequately addressed Objective 10: To ensure equitable biodiversity access and benefit sharing Strategy 1: Promote necessary actions to facilitate equitable biodiversity access and benefit sharing Actions: • Designate authority(ies) responsible for biodiversity and traditional knowledge access (H) • Define considerations for biodiversity access, such as expectations of all parties, impacts on stakeholders, resources required, legal framework required, negotiating training, certificates of origin, protocols for field collection and laboratory work, patents, method of prior inform consent from local/indigenous communities involved, economic benefits (up-front payments, milestone payments, royalties), and duration and termination of access (H)
11	**Parties have improved financial, human, scientific, technical and technological capacity to implement the Convention**	Object 1: To mobilise adequate financial resources for the management and conservation of Barbados' biodiversity of the NBSAP calls for: Objective 2: To develop the human resource base and strengthen institutional capacity for biodiversity conservation and management Objective 3: To conduct essential research to inform the development and implementation of management practices for the sustainable use of biodiversity

6.2.5 PROGRESS MADE TOWARDS THE IMPLEMENTATION OF THE NBSAP OBJECTIVES

The NBSAP details activities that are essential for improving biodiversity management in Barbados. However, there still remains no formal monitoring and reporting system in place to measure the extent to which the activities have been carried out and how they have impacted on achieving the objectives. Continued cooperation among the government, private sector, communities, NGOs, academia and regional and international institutions has resulted in significant progress being made in some areas, but many challenges still remain and these have slowed the rate at which the NBSAP has been implemented.

This section highlights the key successes achieved through the implementation of the NBSAP chief of which has been the establishment of the Natural Heritage Department (NHD) and the effective use of enhanced cooperation to support biodiversity management in the face of human resource challenges. This section underscores the progress made and challenges met in implementing the NBSAP objectives. Table 5 gives a detailed account of the successes achieved and challenges faced in relation to the implementation of the NBSAP

6.2.5.1 OBJECTIVE 2 – ESTABLISHMENT OF THE NATURAL HERITAGE DEPARTMENT IN 2005

The Natural Heritage Department (NHD), MED was established in 2005. The NHD has responsibility for the implementation of the National Park Plan and the development of sites that can serve as attractions and recreational areas while providing opportunities for scientific research and employment of residents. The main objectives of the NHD are: to promote recreation and tourism within the National Park which respects its special environmental qualities and where possible provides social and economic benefits for local communities; the conservation and management of the biodiversity in the area including terrestrial and marine ecosystems, habitats and species; to protect the distinctive character and appearance of each of the National Park's five terrestrial landscape zones and to create and support opportunities for sustainable local economic development through rural tourism, etc[67].

The NHD serves as the technical and administrative focal point for a number of wildlife/conservation and biodiversity related Multilateral Environmental Agreements (MEAs) to which Barbados is a party. These include: the Convention on International Trade in Endangered Species (CITES); the Convention on Wetlands of International Importance Especially as Waterfowl Habitats (RAMSAR); Convention on the Conservation of Migratory Species (CMS), the Convention on Biological Diversity (CBD), The Cartagena Protocol on Biosafety and the SPAW Protocol.

[67] Government of Barbados, Ministry of the Environment, Water Resources and Drainage, 2009. *Economic and Social Report of the Ministry of the Environment, Water Resources and Drainage*

6.2.5.2 ENHANCED COOPERATION

The Ministry of Environment and Drainage has established and is represented on a range of successful Inter-sectoral Committees related to biodiversity management as a primary way to encourage cooperation between government entities, non-governmental organizations and the private sector. The existence and effectiveness of these Committees e.g. The Working Group on Biodiversity and the CITES Scientific Authority serves to improve information sharing among sectors and increases awareness of ongoing activities occurring within each sector. It also serves to minimize duplication and over-lap of effort.

Table 5: Status of the Barbados NBSAP Objectives

NBSAP Objective	Progress made in the implementation of Actions, Focusing on Concrete Results Achieved	Obstacles Encountered in Implementation and Lessons Learned
To mobilize adequate financial resources for the management and conservation of Barbados' biodiversity.	More Officers within the various Government Agencies are aware of funding opportunities offered by some international funding agencies that can support conservation projects and officers are increasingly writing and submitting project proposals to international funding agencies to support their respective work programmes. This effort has complemented the government supported programmes. In addition, NGOs and academia also access international funding to aid in research and conservation projects. Further, the Government of Barbados allocates a considerable amount of its limited financial resources to the Departments and Agencies responsible for biodiversity conservation and management. The challenge remains to identify from which areas additional funds can be taken to support conservation activities. To this end, the Departments have sought to increase their effort in securing international funding to support their work. The establishment of appropriate user fees for biodiversity resource users (for example hoteliers, fisherfolk, SCUBA operators, tour operators) has not yet been implemented	Limited financial resources have affected the hiring of fundraising specialist and Assistant project personnel as called for in the NBSAP. Funding also remains a challenge for Government in relation to the hiring of permanent staff. The hiring of project staff to assist with the implementation of projects is beneficial. However, these benefits are then overshadowed by the fact that there is no staff to monitor the progress of the project outcomes after the project has ended. The Ministry of Tourism has supported research on the valuation of sea turtles and the coral reefs and scuba industry. Such research will help to support and justify calls for the introduction of incentives as tools to assist with biodiversity conservation.
2. To develop the human resource base and strengthen institutional capacity for biodiversity conservation and management	The Natural Heritage Department was established in 2005. The Department's objectives may be summarized to include, but not be limited to the following: • Upgrade, diversify and protect Barbados' tourism product through development of sites that can serve as attractions and recreational areas while providing opportunities for scientific research and employment of residents. • Protect the quality and integrity of ecosystems including air,	Although the Department continues to move forward with its biodiversity programmes and activities, this work is occurring at a significantly reduced pace as a result of inadequate staffing levels. The NHD is currently examining ways to increase the staffing levels to assist with the implementation of the Department's mandate.

	water, land and animal components • Focus on the linkages and relationships among the ecosystems, with special attention to human activities, and consider these components beyond their immediate environs to the broader National Park system, and to the Island system as a whole • Promote the protection, conservation and wise use of Barbadian flora • Establish and develop linkages between the Town and Country Planning Office, the Coastal Zone Management Unit, the National Conservation Commission and Soil Conservation Unit with other Ministries and NGOs • Promote community participation and educational programmes in the Harrison's Cave study area The Department will also be responsible for the establishment of the Marine Management Authority Although the National Park Plan has not been fully implemented the NHD has begun to execute activities within the National Park, the Department has begun to increase public awareness and education aimed at the individuals who live within the confines of the national park, in addition, the NHD has adopted a local primary school within the boundaries of the national park and is working with the students and is hoping to replicate the activities undertaken with this school to others within the national park. Efforts are made to include key personnel within Government in biodiversity conservation and management wherever possible. Efforts are made to establish and/or strengthen links with Governmental and Non-governmental agencies (local and international) with responsibilities related to the conservation and sustainable use of biological resources wherever possible whether it be through their inclusion in relevant meetings or encouraging their participation at workshops and seminars	The Draft EMA will serve as the enabling legislation for the National Park Plan which is policy document that is used as a guide for activities that can be undertaken within the National Park. The absence of this legislation limits the enforcement power of the Department.

	Inclusion of Governmental and non-governmental agencies in the decision making process and frequent dialogue through multisectoral committees help to encourage cooperation between local Governmental and Non-governmental agencies to reduce duplication of activities, and encourage more efficient information sharing The Barbados Herbarium of the University of the West Indies (UWI) currently comprises about 4000 specimens. In 2005, a joint project was started by the UWI and the Barbados Museum & Historical Society to create a virtual herbarium to improve public access to this important regional collection. This project received funding from the MED, the Peter Moores Barbados Trust and the UWI.	
	The Ministry of Environment, Water Resources and Drainage (MED) has developed and is a part of a number of active and effective inter-sectoral Committees which have improved the information sharing among entities and has contributed to the reduction of duplication of effort. In addition many senior technical or management officers sit on some of these committees NGOs/Private sector and academia are involved in the policy making process through participation in stakeholder sessions/meetings/surveys and inclusion on committees NGOs and academia work closely with government Departments on conservation projects	One of the Challenges of this approach is to ensure that the information that is passed on to Departments through individuals is actually shared with the entire Department where relevant and that it is taken on board and incorporated into their programmes and activities where relevant.

3. To conduct essential research to inform the development and implementation of management practices for the sustainable use of biodiversity	The MED has conducted surveys of plant nurseries and pet shops in order to monitor the types of species which are imported into the country. Studies have also been done by MED, Ministry of Agriculture (MAR), other Government Agencies, University of the West Indies (UWI), BMT and other entities such as regional institutions and international universities on a variety of species e.g. cattle egrets, African green monkey, bats, beach vegetation, birds, mollusks, terrestrial plants, coral reefs, snakes, invertebrates and fisheries resources The University of the West Indies has been an invaluable source of information relevant. Research on biodiversity is being conducted on an ongoing basis. The NCC established a Community Reef Watchers Programme that has as its objectives to build capacity of local divers so that they can contribute to safeguard the reefs within the FPMR and to develop a coral reef monitoring data base for Folkestone. This is intended to be a long term programme and the volunteers submitted their first report in October 2009. The report identifies the status of the fringing, patch and bank reefs located within the FPMR; impacts affecting the coral reefs and indentifies lessons learnt from community based coral reef monitoring.[68]	The MED has been unable to develop a full reference collection of the research conducted due to human resource constraints. However, there is a considerable amount of data available from different sources. The challenge with this data is that it exists in different formats and is stored in different ways and therefore collation may be difficult.
	Significant research has been done on the Barbados sea turtle populations by the Barbados Sea Turtle Project A GIS was also developed specifically for biodiversity in Barbados and includes information on indigenous, rare and threatened species	Updating the GIS of biodiversity information within the Ministry of Environment and Drainage remains a challenge

[68] Government of Barbados, Ministry of the Environment, Water Resources and Drainage, 2009, *Economic and Social Report of the Ministry of the Environment, Water Resources and Drainage*

	The Ministry of Agriculture hosts an annual National Agricultural Research Conference and research continues to be done on a variety of crops including hot peppers, parsley, thyme, tomatoes, root crops, sweet peppers etc. The areas of research and focus have been determined largely by the need for : Sustainable farming technique (reduced external inputs/friendly to environment) especially in the context of concerns and plans regarding biosafety) Intensified production Improving plant material (adapted to local conditions) Support for commodity crops such as hot peppers, onions, herbs etc Enhancement of competitiveness Advancement of technologies that might attract young farmers Food security (root crop production integral)	
	The Barbados Herbarium of the University of the West Indies (UWI) Cave Hill Campus was established in 1977 and is a reference collection of dried plant specimens recording the plant diversity of Barbados and the Eastern Caribbean[69]. The Barbados Herbarium currently comprises about 4000 specimens. In 2005, a joint project was started by the UWI and the Barbados Museum & Historical Society to create a virtual herbarium to improve public access to this important regional collection. This project received funding from the MED, the Peter Moores Barbados Trust and the UWI. The virtual herbarium was eventually launched in January 2009. The Barbados Herbarium is listed under the acronym BAR in the worldwide Index Herbarium.[70]	

[70] http://ecflora.cavehill.uwi.edu/vhmain.php

	Researchers have their individual connections and continue to communicate with each other in the absence of a single the national clearing house. However, many Government Agencies, NGOS and academic and regional institutions have their own websites which are used as clearing houses. Overall there has been no Preparation and implementation of a single prioritized programme on biodiversity research, incorporating appropriate governmental and non-governmental agencies, students and staff of UWI, polytechnics and colleges, schools, communities and user groups in appropriate elements of the programme.	The continuous update of the information of these websites remains a challenge for some government departments.
4. To use the results of the Research Programme to develop appropriate management techniques and mechanisms to ensure sustainable consumptive use and to preserve non-consumptive use values of biodiversity resources	A number of management plans have been developed e.g. National Park Plan, Graeme Hall Management Plan, Draft Beach Management Plan, Integrated Coastal Zone Management Plan, Integrated Gully Ecosystems Management Plan, Sea Turtle Recovery Action Plan and the Fisheries Management Plan Many aspects of the Fisheries Management Plan have been implemented and are monitored. The Fisheries Management Plan contains taxon specific management plans and is updated on a continuous basis. The Sea Turtle Recovery Action Plan (1992) was developed and continues to be implemented by the Sea Turtle Project of the University of the West Indies. The work of this project and the Fisheries Division of the Ministry of Agriculture has been responsible for the reduction in mortality of adult sea turtles and hatchlings through monitoring, research, management and public awareness initiatives. One of the objectives of the Draft Beach Management Plan includes ensuring the protection of wildlife and habitat within the coastal zone.	The National Park Plan remains largely unimplemented due to legislative, financial and human resource constraints. Lack of or inability to enforce legislation or fully implement the measures outlined in some plans remains a challenge.

	The Integrated Gully Ecosystem Management Plan provides various strategies that may facilitate the achievement of this objective. However, specific taxon management is covered under general reference to biodiversity management in overarching country plans	
5. To revise, consolidate and formulate policy and legislation to achieve the conservation and sustainable use of biodiversity	There are several policies, plans and pieces of legislation in existence to assist in the conservation and sustainable use of biodiversity. There is draft legislation in existence namely the Draft Environmental Management Act (EMA) which will consolidate many biodiversity related and environmental management issues.	The pace at which legislation is drafted and finalized is often extremely slow. As a result, when the legislation is finally enacted it is somewhat outdated and may need to be amended when it has been finally enacted. The finalization of the Environmental Management Act remains a challenge.
6. To promote biodiversity conservation and sustainable use through incentives	No Incentive packages have been developed to date. However, the UWI is currently involved in ongoing research that is looking at the value of sea turtles and fishery Resources (reef fish, ecosystem services etc.), the valuation of the long line fishery. The Ministry of Tourism has supported research on the valuation of sea turtles and the coral reefs and scuba industry. Such research will help to support and justify calls for the introduction of incentives as tools to assist with biodiversity conservation.	
7. To incorporate conservation requirements into land-use planning	The Physical Development Plan (PDP) (Amended 2003) was Adopted in 2007 and is always used as a guide to assess development applications that may affect biodiversity resources. Section 17 of *the Town and Country Planning Act, CAP.240* makes Supplementary provisions as to applications for planning permission for an assessment of the impact that the development in respect of which planning permission is being applied for is likely to have on the environment of Barbados. This is discretionary as *"Application to the Chief Town Planner for planning permission shall be made in such form and shall include such drawings and other particulars as may be prescribed; and in particular* ***if requested*** *by the Chief Town Planner,* ***may be accompanied [...]"*** . However, pursuant to 17(1A) where part or all of the development	Stakeholders have indicated that there have been some challenges experienced in the implementation of the PDP in some instances.

	or use of land for which planning permission is being sought occur in the coastal zone management area as defined by the *Coastal Zone Management Act*, the Chief Town Planner shall request an assessment. The National Botanical Gardens is responsible for the introduction of the Green Deficit Management Programme (GDMP) and this represents the importance of the proposed National Silvicultural Management Support Programme. The GDMP is an initiative that targets open spaces, and its primary aims are to one, create new green spaces at strategic locations across Barbados, and rehabilitate existing green sites where trees are deformed, defective, stressed, over-mature, etc. and threaten public safety.	
8. To improve public awareness and education	Departments of the Ministry of the Environment have adopted primary and secondary schools with which they work annually. The Ministry's environmental education programme in the schools remains consistent with, continuous production and dissemination of public awareness materials, officers conducting tours and giving presentations at schools, essay and poster competitions. In addition general public education and awareness activities are also geared toward the general public and specific target audiences using television, radio and print media, discussion forums and training sessions are also executed.	Human and financial resource constraints hinder wider coverage of the nation's schools and more sustained public awareness campaigns
	The Government currently pays the tuition of Barbadian students studying for a Masters degree at the Centre for Resources Management and Environmental Studies (CERMES), UWI Cave Hill, in addition the government also covers tuition fees for students studying for degrees related to the environment at the bachelors level at the other UWI campuses e.g. Biology The Government also offers loans through the 'Student Revolving Loan Scheme' if the study to be undertaken is not available at the local University with the proviso that students work in the country for two years after their studies have been completed	

9. To establish effective in situ and ex situ biodiversity conservation measures	This objectives has been identified in the National Physical Development Plan (Amended 2003) but remains largely unimplemented. However, progress has been made in some areas The Folkestone Park and Marine Reserve is the only legislated Marine Protected Area in Barbados The Graeme Hall Swamp has been designated as a RAMSAR site	NHCA have not yet been officially implemented. Implementation of this activity depends on the establishment of the National Park and Sites. The Natural Heritage Conservation Areas and National Forest Candidate sites remain paper parks up to the time of reporting
	The National Conservation Commission (NCC) has already established a Park service with wardens that oversee activities at parks and beaches. The Terms of Reference for these officers may need to be broadened or additional officers with responsibility for the National Park may need to be hired.	
10. To ensure equitable biodiversity and traditional knowledge access and benefit Sharing	Barbados does not have significant problems as it relates to access and benefit sharing and has maintained compliance with the related Articles of the CBD The Natural Heritage Department is the designated authority responsible for biodiversity and traditional knowledge access There has been some work done in relation to the documentation of traditional knowledge e.g. pamphlets and books on the medicinal and other health benefits of local species.	
11. To establish biosafety regulations in order to safeguard biodiversity	National Biosafety Framework Project has been completed. The Ministry of Agriculture has been proposed to assume responsibility for the implementation of the National Biosafety Framework. The NHD will remain the focal point for the Cartagena Protocol on Biosafety.	The National Biosafety Framework Implementation Project has not yet commenced primarily due to delays in finalizing the scope of the Regional NBF Implementation Phase project
12. To promote the conservation and sustainable use of biodiversity in various sectors (agriculture, health, fisheries, tourism)	Continuous education and awareness programmes in this regard are employed by the MAR, Ministry of Health (MOH) and the MED in this regard. These ministries often collaborate to produce awareness initiatives that highlight the issues related to each Ministry in a coherent way. These agencies have developed plans and programmes that promote conservation and sustainable use of biodiversity. For e.g. The Fisheries Division is the lead agency	

	responsible for managing the Barbados Fishery. The Fisheries Management Plan 2008-2011 identifies taxon specific and general activities, plans and programmes to effect fisheries management. The Fisheries Division also works closely with the University of the West Indies which conducts research to inform and keep successive management plans relevant; The Ministry of the Tourism is seeking to develop a tourism master plan that will take biodiversity management issues and recommendations outlines in the numerous environmental management plans into consideration. Government is also working on a plan that addresses synergies for environmental projects. The CARDI Barbados Unit is responsible for the breeding and maintenance of hot pepper germplasm. Other aspects of the hot pepper improvement programme involve the determination of possible sources of viral infection, and the deployment of newer technologies to optimize production. CARDI Barbados is also involved in livestock research and development. No subsidies are currently offered but funding is made available for environmental projects e.g. projects that have a focus on conservation, recycling etc. may be provided with some funding from government.	

6.2.6 DOMESTIC AND INTERNATIONAL FUNDING OF NBSAP OBJECTIVES

The Government of Barbados provides financial resources through the consolidated fund to the Departments of the Ministry of Environment and Drainage as well as other Ministries and Departments whose work programmes contribute to biodiversity conservation and management. However, the amount of funds allocated is not always adequate to undertake the work and as a result, funding is often sought from external sources e.g. the Global Environment Facility, United National Environment Programme (UNEP), United Nations Development Programme (UNDP), United States Agency for International Development (USAID) to undertake projects that may directly or indirectly contribute to biodiversity conservation and management.

Additional contributions by the Government of Barbados to biodiversity conservation and management are made through the payment of the tuition of Barbadian students studying in biodiversity related areas at the CERMES, UWI; the provision of funding to academic institutions, CBOs and NGOs to support research and conservation projects. These entities also seek international funding from external sources e.g. WideCast, GEF Small Grants Programme, FAO, USAID to carry out biodiversity conservation and management projects.

6.2.7 EFFECTIVENESS OF THE NBSAP

This section looks at the effectiveness of Barbados' NBSAP in meeting the requirements of the relevant Articles and Programmes of the CBD and, the effectiveness of the NBSAP in meeting national objectives.

The overall goal, specific objectives and strategies which form the foundation of the National Strategy and Action Plan attempt to address the range of issues relevant to the management of biodiversity, from the development and implementation of a national biodiversity policy to research requirements for specific species. Since the publishing of the NBSAP in 2002, Barbados has been able to make some progress in the achievement of several NBSAP objectives. There has been a significant amount of work done in the areas of research and conservation of some key local species. However, no formal mechanism for monitoring its effectiveness has ever been put in place. The major administrative achievements have been identified as the establishment of the Natural Heritage Department, the establishment of various management plans and enhanced cooperation through the establishment of successful Inter-sectoral Committees which contribute to the management and conservation of biodiversity.

While it is evident that the programmes and activities undertaken by the NHD with the assistance of the Working Group on Biodiversity are directly geared towards the implementation of the CBD using the NBSAP as a guide; during the preparation of the Fourth National Report, it appeared that in many cases the work done in the area of biodiversity research and management was actually being executed outside of this Department (by Government Agencies/Departments academia and NGOs which are represented on the Working Group on Biodiversity) either because of a national need or interest which needed to be fulfilled. The outputs of this work then indirectly contributed to the fulfillment of one or more NBSAP objective(s).

A review of the NBSAP has revealed that the document may not be adequate to address the threats identified. The threats to biodiversity are listed but actual coordinated strategies to address these have not been identified within the document. In addition, many specific targets were identified and ranked in terms of priorities however, many of these have not yet been achieved. In view of the foregoing, the NBSAP document may need to be reviewed to determine whether the objectives, targets and associated activities listed are still relevant to the Barbados Programme of work on Biodiversity and then include specific strategies and actions that need to be employed to address specific threats identified and more importantly achieve NBSAP objectives. On completion of the assessment it is then recommended that a more focused effort be made to working towards achieving the targets identified within the document that have not yet been achieved.

Some of the key Obstacles to the implementation of the NBSAP Objectives have been outlined in Table 5 and if these can be overcome significant progress will be made in relation to the implementation of the NBSAP. The document provides a wealth of information and if effectively utilized can coordinate the activities of the many stakeholders working in the area of biodiversity conservation and management.

6.2.8 CHALLENGES AND LESSONS LEARNT

Some of the key challenges impacting on the effectiveness of the NBSAP and overall biodiversity conservation and management are as follows:

- The inordinate length of time it takes for draft legislation to be finalized and enacted.
- The lack of enforcement of existing legislation
- the increased pressure placed on species populations as a result of habitat destruction and reduction in food supply.
- The lack of staff within the MED to implement biodiversity conservation and management programmes
- Absence of a formal system in place for monitoring and reporting on the progress of the NBSAP

In spite of the challenges faced over the years the Government of Barbados has worked with its non-governmental partners to pool human and financial resources where possible to achieve biodiversity conservation and management objectives.

7 SECTORAL AND CROSS SECTORAL INTEGRATION OR MAINSTREAMING OF BIODIVERSITY CONSIDERATIONS

7.1 INTRODUCTION

The need for the integration of biodiversity considerations into overall national policy frameworks has been emphasized by the Convention on Biological Diversity. In this regard, the Government of Barbados recognizes that biodiversity is critical to the overall development of the country and has sought to include the mainstreaming of biodiversity into the national policy framework.

Barbados has made some progress in relation to the mainstreaming of biodiversity and this chapter examines the sectoral and cross sectoral plans, policies and programmes into which biodiversity management and conservation have been integrated.

7.1.1 OVERVIEW OF BIODIVERSITY MANAGEMENT FRAMEWORK

In Barbados, the responsibility for the management of biological resources is distributed across several Government Ministries. There are also a number of non-governmental organizations (NGOs) and other entities involved in the conservation of biodiversity. Due to the decentralized approach to biodiversity management, a myriad of institutions and agencies have their own legislative mandate, administrative procedures, resources, work programmes and priorities.

The management of biodiversity in Barbados is guided primarily by a number of policy documents (i) The National Strategic Plan of Barbados 2006-2025, (ii) National Biodiversity Strategy and Action Plan (iii) Barbados Sustainable Development Policy (2004) and (iv) Physical Development Plan.

National Strategic Plan of Barbados :2006-2025

The National Strategic Plan (NSP) of Barbados 2006-2025: *Global Excellence, Barbadian Traditions* sets out Governments main development agenda for the 20 year period 2006-2025. Goal 4 “these fields and hills” is aimed at strengthening the physical infrastructure and preserving the environment. Objective 1.1 of Goal 4 seeks to promote and facilitate the environmentally sustainable use of our natural resources. The NSP sets this out for terrestrial and marine ecosystems through the following strategies:

- Integration of environmental considerations into all aspects of national development;
- Encourage the participation of civil society and the private sector in environmental management;
- Ensure that the integrity of natural features, wildlife habitats, significant flora and fauna, and important landscape and seascape features and protected areas are maintained during the process of development;

- Promote public education awareness and appreciation of the direct inter-relationships among the three pillars of economic growth, social justice and equity and environmental management;
- Ensure effective conservation of the islands coastal and marine ecosystems and living resources, improving their quality;
- Promote sustainable land management practices;
- Promote the development of green and open spaces throughout the island

National Biodiversity Strategy and Action Plan (NBSAP) 2002:

The Biodiversity Strategy and Action Plan presents an overall goal with specific objectives and affiliated strategies and actions which should be applied to the various components of biodiversity i.e. Natural Vegetation, Agriculture, Land Resources, Terrestrial Fauna, and Marine and Freshwater species.

The overall goal, specific objectives and strategies which form the foundation of the Strategy and Action Plan attempt to address the range of issues relevant to the management of biodiversity, from the development and implementation of a national biodiversity policy to research requirements for specific species.

The strategies and actions that will be implemented to achieve the stated objectives are described in the Action Plan. The plan also identifies the priority of the proposed actions and the various institutions that will be potentially involved in the implementation of the strategy and action plan.

Barbados Sustainable Development Policy 2004:

The overarching goal of the Policy is ***"to ensure the optimization of the quality of life for every person by ensuring that economic growth and development does not occur to the detriment of our ecological capital."*** The major objectives of the Policy are:

1. to formulate a national definition of sustainable development;
2. to provide a national framework for decision-making based on our principles of sustainable development;
3. to promote principles of sustainable development and encourage all persons to adopt and apply these principles in every aspect of decision-making; and
4. to sensitize and educate all persons in Barbados about key issues and conflicts between development and environment and the need to make wise consumption and production choices.

The Barbados Sustainable Development Policy defines the overarching framework that promotes the development of the economic and social capital while ensuring the wise and proper stewardship of the environmental capital. The objectives of this plan will be achieved through a number of strategies including *bio-physical "limits to growth".* These limits include the

- Finite supply of some resources;
- Natural carrying capacity of ecosystems;

- Fragility and vulnerability of some ecosystems;
- Finite resilience of ecosystems to resist and recover from exploitation and
- Limited waste assimilation capacity of the natural environment

The Action Plan details the way forward and reference to biodiversity are found in a number of sections:

Agriculture:...."in pursuit of sustainable agriculture consideration will be given to biodiversity preservation"

*Terrestrial Biodiversity...."*ensure sustainable use of terrestrial biodiversity in part through the implementation of a strategy which preserves, conserves and sustainably uses the island's terrestrial \resources of flora and fauna.

Fisheries:....." preserve rare or fragile ecosystems, ecologically sensitive areas and endangered species.....

*Biotechnology....."*continued support for research into the national status of biodiversity resources to develop a comprehensive database/inventory. Articulation of management plans for all species especially hose which are unique, exotic or of particular value for use in biotechnology."

Coastal and Marine Resources ....." designating specific marine areas for protection and preservation. Providing for maintenance and/or rehabilitation of coastal environments and their resources"

Physical Development Plan Amended 2003

The Government of Barbados has recognised the importance of protected areas and under the Environmental Management and Land Use Planning for Sustainable Development Project a National Park Development Plan was prepared which seeks to promote conservation, management and ecosystem enhancement. The plan sets out the National Park and its boundaries as well as Natural Heritage Conservation Areas.

The National Physical Development Plan for Barbados therefore recognises a system of parks and open spaces for Barbados through a *National Park Plan*. One important component of this system for biodiversity conservation is identification of National Forest Candidate sites.

(i) The plan utilizes an ecosystem approach with the primary objectives of protecting the quality and integrity of ecosystems and to focus on the linkages and relationships among the ecosystem components. The maintenance and promotion of viable species population is another objective

Medium Term Development Strategy – Building the Green Economy

Government's Medium Term Development Strategy 2010 – 2014 makes provision for building a green economy. The notion of a green economy is nothing new since the Government of Barbados has been pursuing various elements of a Green Economy

throughout the country's development. The Green Economy has been defined as an emerging global marketplace model that seeks to respond to the world's major environmental problems by optimizing social, economic and environmental value- this is most commonly referred to as the "triple bottom line" or the three pillars of Sustainable Development. Greening the economy requires the reconfiguring of business and infrastructure to deliver better returns on natural, human and economic capital investments, while at the same time reducing greenhouse gas emissions, extracting and using less natural resources, creating less waste and reducing social disparities. Significant achievements at the national level in this respect include, among others:

1. The design of Barbados' finance and institutional structures to support environmental management and restoration. Most notable is the annual estimates process that provided in excess of US$70,000,000.00 equivalent to support programmes geared towards the preservation of the environment in 2009 -2010 estimates via the Ministry of Finance

2. Large scale investment in protecting ecological infrastructure via the Soil Conservation Programme for the Scotland District

3. The establishment of a network of managed zones, parks and the preservations of coastal seascapes maintained under the aegis of the NCC

4. Instituting Environmental Impact Assessment tools into the development planning and control process

5. The national consensus among government, the private sector and members of civil society to adopt core principles for sustainable development as articulated by the National Commission on Sustainable Development in the 2004 Barbados Sustainable Development Policy

6. Commitment to global environmental partnerships via bilateral cooperation programmes, multilateral environmental agreements and intergovernmental sustainable development governance processes

7. The articulation, debate and approval of the financial and economic statement in 2007 to stimulate private sector involvement in the pursuit of the Barbadian Green Economy

National Park Plan

The Barbados National Park Plan establishes policies to guide future land use and development within the boundaries of the National Park. The main objective of the National Park is the "*conservation and enhancement of the biodiversity in the terrestrial and marine ecosystems, habitats and species*".

International Commitments

Barbados became a signatory to the Convention on Biological Diversity in 1995, in addition to a number of other regional and international treaties.

Table 6: International Conventions to which Barbados is a Party

Convention	Date Signed	Responsible Ministries & Executing agencies
United Nations Convention on Biological Diversity.	Barbados became a party 10 December 1993.	Ministry of the Environment, Ministry of Finance, and the Ministry of Agriculture and Rural Development.
The *Convention on International Trade In Endangered Species*	Barbados became a party 9 December 1992	Ministry of the Environment, Ministry of Agriculture and Rural Development, and the Ministry of Foreign Affairs and Foreign Trade
United Nations Framework Convention on Climate Change and Kyoto Protocol	Barbados became a party 23 March 1994	Ministry of the Environment.
United Nations Convention on the Law of the Sea	Barbados became a party 12 October 1993	Ministry of the Environment, and the Ministries of Agriculture and Rural Development.
The Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartegena), and the Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean Region, (OILSPILL Protocol)	*Barbados became a party to the Cartagena Convention and the OILSPILL Protocol 28 March 1985*	Ministry of the Environment, Ministry of Agriculture and Rural Development, and the Ministry of Foreign Affairs and Foreign Trade.
Convention to Combat Desertification	Barbados became a party on May 14, 1997.	Ministry of the Environment, Barbados Water Authority, and the Ministry of Agriculture and Rural Development
The Vienna Convention for the Protection of the Ozone Layer, and the Montreal Protocol on Substances that Deplete the Ozone Layer	Barbados acceded to the Convention and Protocol on July 20 1994.	Ministry of the Environment
The UN Fish Stocks Agreement	Barbados became a party on September 22, 2000	*Ministry of Agriculture and Rural Development*
FAO Compliance Agreement	Barbados became a party on October 26, 2000	Ministry of Agriculture and Rural Development
International Commission for the Conservation of Atlantic Tunas	Barbados became a party on December 13, 2000	Ministry of Agriculture and Rural Development

Institutional Arrangements

In Barbados, the management of biological diversity is the responsibility of several Government Ministries. There are also a number of non-government organizations and entities involved in the conservation of biodiversity. The decentralized approach to biodiversity management has resulted in a situation whereby a myriad of institutions and agencies have their own legislative mandate, administrative procedures, resources, work programmes and priorities. This has led to some apparent direct conflict between the various mandates of the respective Ministries or departments. For example the Town and Country Development Planning Office which administers the Physical Development Plan is more focused on physical development compared with the Ministry of Environment whose primary mandate relates to the protection, conservation and management of the environment. Table 7 shows the mandates of the various Government Agencies as in relation to biodiversity management.

Table 7: Agencies Responsible for Biodiversity Management in Barbados

Agency	Responsibilities
Natural Heritage Department	Protecting the quality and integrity of ecosystems including air, water, land and animal components. ii. Focus on the linkages and relationships among the ecosystems, with special attention to human activities, and consider these components beyond their immediate environs to the broader National Park system, and to the Island system as a whole. iii. Promote the protection, conservation and wise use of Barbadian flora
National Conservation Commission,	Conservation of the natural beauty, topographic features, historic buildings, sites and monuments of Barbados. ii. Development of a network of protected areas, both marine and terrestrial.
The National Botanic Garden,	Conducting silvicultural and dendrological research on indigenous, naturalized, endangered, rare and endemic plant species existing on open spaces across Barbados ii. Develop the nature tourism potential of green spaces for integration into the national tourism product
Coastal Zone Management Unit (CZMU),	To develop standards for water quality in coastal and marine areas to effect the maintenance, rehabilitation and enhancement of coastal and marine habitats. ii. To determine temporal changes in coral reef communities, and to develop necessary measures to protect, rehabilitate and enhance coastal and marine habitats.
Fisheries Division, Ministry of Agriculture	The ***Fisheries Division*** is responsible by law for fisheries management including conservation of resources and development of the fisheries.
Town & Country Development Planning Office	The Town and Country Development Planning Office (TCDPO) has the responsibility for the orderly and progressive development of Barbados. In an effort to meet this challenge and to ensure that development is sustainable, the TCDPO uses the Physical Development Plan as a broad administrative policy tool to chart settlement, growth patterns and the allocation of land to various uses

Existing Legislation

Barbados has no overarching legislation designed specifically to deal with biodiversity conservation and management. Applicable environment legislation currently in force in Barbados is dispersed across several statutes and departments of government. These pieces of legislation were all enacted over a long period of time. Some legislation were prepared long before the modern environmental movement and therefore were not intended to address current issues and environmental concerns. There is a need therefore to modernize the legal framework governing conservation and protection of biological diversity. In addition, there is also currently no comprehensive legislation in Barbados governing terrestrial protected areas. Marine protected areas were described under the Marine Areas (Preservation and Enhancement) Act (Cap 392) but this Act has been repealed and incorporated into the more all-encompassing Coastal Zone Management Act . The most prominent pieces of legislation providing statutory protection of the environment are described in the following section.

7.1.1.1 LAND USE

The ***Town and Country Planning Act (cap.240)*** makes provision for the orderly and progressive development of land. The Act provides for the preparation of a Physical Development Plan by the Chief Town Planner (CTP) which may make provision for: (i) allocation of lands as open spaces, communal parks, bird and other sanctuaries, protection of marine life; (ii) preservation of sites of artistic, architectural, archaeological or historical interest; (iii) preservation or protection of forests, woods, trees, shrubs, plants and flowers; (iv) regulation and control of the deposition of waste materials, refuse, sewage and the pollution of rivers, lakes, ponds, gullies and the seashore.

The ***Land Acquisition Act (cap. 228)*** makes provision for the acquisition of land for public purposes, such as the development of parks or caves.

The Constitution (Section 16) provides for the protection from deprivation of private property. The establishment of protected areas or the imposition of planning restrictions that deprives the land of its value could attract legitimate claims for compensation. S.16 allows for the confiscation of property in circumstances where the environment is threatened.

7.1.1.2 PROTECTED AREAS/HABITATS

The Soil Conservation (Scotland District) Act (cap.396) restricts the use to which land can be put in the Conservation Area known as the Scotland District. The Scotland District comprises both the hinterland and the coastal zones in the parishes of St. Peter, St. Andrews, St. Joseph and St. John.

The National Conservation Commission Act (cap.393) establishes the National Conservation Commission (NCC) which has, as one of its main functions to conserve the natural beauty of Barbados; control and develop public parks; public gardens, beaches and caves; advise on the removal of coral from the ocean bed; and regulate commercial activities in public parks, gardens, caves, and on beaches.

The Trees (Preservation) Act (cap.397) provides that the killing of any tree one metre or more in circumference is an offence unless a permit has been obtained from the Chief Town Planner (CTP). The Act also empowers the CTP to require the owner of vacant land or land

adjoining or near a public road to plant or replant trees and to clear land of weeds or overgrown grass.

The Cultivation of Trees Act (cap.390) promotes the cultivation of certain species of trees through the financial incentive of receiving a tax contribution payment equivalent to the amount of taxes payable in respect of the land so cultivated, the payment of a fruit tree subsidy or subsidy payment. Species currently approved for the incentive scheme are mahogany, casuarina, teak, tamarind and coconut. This piece of legislation only stresses however non-native species and efforts should be made to promote incentives for the cultivation of species, which are indigenous to Barbados.

7.1.1.3 AGRICULTURE/LIVESTOCK

The Town and Country Planning Act (cap.240) contains some provision relevant to agriculture and livestock. These include the use of any land for the purposes of agriculture or forestry, including forestation and the use of any agricultural purpose, other than dairy farming and the breeding and keeping of livestock, including any creature kept for the production of food, wool, skin or for the purpose of its use in farming the land.

The Barbados Agricultural Development and Marketing Corporation Act (BADMCA) (12/1993) establishes the BADMC with responsibility for the stimulation and development of agriculture. The Corporation is mandated to develop and manage, on a commercial basis, such plantations and other agricultural land that may be vested in it and to stimulate and encourage the private sector.

7.1.1.4 MARINE RESOURCES

The Barbados Territorial Waters Act 1977 (1977-26) which defines the territorial waters of Barbados as existing within 12 nautical miles around the island. Section 3 (2) provides that these waters, including the underlying seabed and subsoil, form part of the territory of Barbados and are, therefore, subject to full territorial sovereignty. Foreign vessels have a right of innocent passage through the territorial waters but not if the captain or other person in charge of the ship engages in any calculated act of pollution or acts likely to cause harm to Barbados' resources or its marine environment.

The Marine Boundaries and Jurisdiction Act 1979 (cap. 387) establishes a 200 mile EEZ in which sovereign rights are vested in the Government of Barbados in respect of the exploration, exploitation, conservation, protection or management of the natural living and non-living resources of the sea-bed, subsoil and superjacent waters; and the preservation and protection of the marine environment and the prevention and control of marine pollution. Barbados has all other rights in and jurisdiction over, the EEZ recognized in international law.

The Fisheries Act 1993 (cap. 391) addresses the provision for the management and development of fisheries (including protection of endangered and critically endangered sea turtles from exploitation) in Barbados.

The Fisheries Management Regulations (1998) address closed areas and seasons, fishing methods and equipment to be adopted, and protective measures for lobsters, turtles, sea eggs and tuna.

The Marine Pollution Control Act Cap 392 (1998) focuses on the quality of the marine waters on the south and west coasts of the island. The legislation has been approved to help combat the steadily deteriorating coastal water quality in some locations that has resulted due to the increased physical development occurring along the coastline over the last three (3) decades. As in all coastal island states dependant on marine resources, poor water quality poses a serious threat to human, fisheries and marine ecosystem health. Overall, the legislation seeks to prevent, reduce and control pollution form its various sources. It recognizes that much of the marine pollution affecting coastal waters originates from land based sources and activities

The Coastal Zone Management Act (1998-39) provides a comprehensive statutory basis for coastal management and planning in Barbados. It seeks to coordinate and update the existing fragmented statutes relevant to coastal management and makes provision for critical areas of concern not covered by current legislation. The Act provides the legal basis for the preparation of a Coastal Management Plan, which establishes and clearly sets out Government's coastal management policy and technical guidelines for the use and allocation of coastal resources. The Act specifically deals with protection of marine resources, for example destruction of corals and fouling of the foreshore. It also encompasses the designation of Marine Protected Areas and Marine Parks. This Act repealed the ***Marine Areas (Preservation and Enhancement) Act (cap.392).***

7.1.1.5 PROTECTION OF WILD FLORA AND FAUNA

The *International Trade in Endangered Species* of Wild Fauna and Flora Act 2006-3

The Act applies to species listed in the CITES appendices as well as to the export of species native to Barbados that may be adversely affected by trade. For the purpose of administering the requirement of the Convention, the Act establishes, a Management Authority and a Scientific Authority for the purpose of establishing control over the international trade in any specimen of species listed in the Second Schedule. The Act also applies to all plant and animal species listed in the Second and Third Schedules of the Act.

The Management Authority has a number of responsibilities, including, *inter alia*, issuing and/or suspension of permits and certificates in respect of the importation, exportation, and re-exportation of endangered species of wild fauna and flora in accordance with the provisions of the Convention and stipulating any conditions that may be attached to the permits or certificates; promoting public awareness; assessing whether an importer can adequately provide necessary accommodation and providing adequate accommodation for a seized or forfeited animal. It is also required to maintain records of international trade in the species prepare annual reports for species listed in the Second Schedule and their submission to the Convention within a specified period. The Act also makes provision for the establishment of a the Scientific Authority, which is charged with the responsibility, among others, of advising the management authority on whether any species is vulnerable, threatened, endangered or extinct as well as on matters in respect of which advise is sought by the Management Authority.

The ***National Conservation Commission Act 1982 (cap. 393)*** addresses the protection of flora and fauna found in caves.

The ***Wild Birds Protection Act Cap 398*** **(WBPA)** provides for the protection of some forty-six (46) species of wild birds specified in the schedule. Any person who knowingly kills or wounds or attempts such an act is liable to a fine, one-half of which is payable to the informant. Possession or export of the skin or features of any wild bird is also an offence, which is punishable by a fine. The only exception is the killing of wild birds for the purpose of obtaining specimens for natural history provided a licence has been obtained by the Minister (not defined) to do so.

The ***Protection of New Plant Varieties Act (2000-17)*** was formulated because of legal obligations imposed by the World Trade Organization. It basically addresses, amongst other issues, the qualification of rights of plant breeders, their entitlement to protection, licenses and criminal liability in respect of variety denomination. This act seeks to protect property rights with respect to flora, and therefore can be used as a tool to regulate and control biodiversity access.

7.1.2 CROSS-SECTORAL BIODIVERSITY CO-ORDINATION

The protection and management of biological resources is shared among various entities. These agencies vary in their mandates and responsibilities and include governmental, non-governmental, academic and other major groups. These bodies vary in their roles depending for example on whether they are technical, policy oriented, administrative, or advisory in nature. The challenge therefore is to ensure adequate coordination across these different bodies. Efforts at ensuring coordination are both formal and informal including the establishment of multi-disciplinary and multi-agency steering committees, formal Memoranda of Understanding and less structured arrangements based on good-will among stakeholders. Examples include the Working Group on Biodiversity which is a technical body that performs an advisory function. There is the National Commission on sustainable Development which was established to oversee the pursuit of sustainable development in the island. In addition to these there are various sectoral and departmental bodies that are more focused on specific issues or concerns affecting biodiversity management

Some progress has been achieved in biodiversity management through these institutional arrangements but there is much room for further improvement with the provision of adequate resources.

7.1.3 CROSS-CUTTING NATIONAL PLANS AND STRATEGIES

Tourism Plan

The NBSAP has as its 12th Objective: "To promote the conservation and sustainable use of biodiversity in various sectors (agriculture, health, fisheries and tourism). A detailed list of strategies and actions are provided for the tourism sector, some examples of these are:

- Promote only small- scale, fully-trained guided tourism in important biodiversity areas.
- Prevent high impact tourism development in currently undeveloped areas of significant biodiversity importance.

In 2001 the Ministry of Tourism submitted a Green Paper on the "Sustainable Development of Tourism in Barbados-A Policy Framework" which was used to guide the sustainable development of the tourism industry in Barbados in the short to medium term. The Sustainable Development of Tourism in the Barbados Policy Framework has been developed by the Government and addresses the natural environment. The specific objective is to promote sustainable tourism development through the protection, conservation and development of the natural environment within its carrying capacity and through education and awareness of, and respect for, the country's unique natural heritage.

In 2008, the multi-sectoral Tourism Advisory Council which provides advice to the Minister of Tourism on critical issues impacting the industry-reviewed the Policy Framework in light of the current international climate.

The Government of Barbados has taken the decision to develop a policy framework, plan and strategy, which will guide and provide specific prescriptions for the future growth and development of the tourism industry in Barbados over the ten (10) year period 2012-2021 in the form of a Tourism Master Plan (TMP). The policy and planning framework will ensure that the tourism industry grows in a manner that is economically, socially and environmentally sustainable and thus able to meet the future needs of Barbadians, visitors, investors and other stakeholders. Currently the Ministry is seeking to develop a Tourism Master Plan 2012 -2016

Agricultural Plan:

The Fisheries Management Plan 2004-2006 contains within the Fisheries Code of Conduct *Code of conduct for responsible fisheries* specific articles addressing biodiversity. In particular, Article 6 of the Code sets out general principles which are summarized below and serve as the guiding principles for fisheries management in Barbados.

- Maintain biodiversity and use ecosystem approaches to management;
- Manage fishing capacity and fishing methods to facilitate resource sustainability;
- Use precautionary approaches to sustainable use, management and exploitation;
- Integrate fisheries into coastal area management to ensure that the needs of coastal communities are met without harming fragile coastal ecosystems;
- Protect and rehabilitate critical fisheries habitats and the environment generally;

Plant Protection:

The mandate of Plant Protection is the phytosanitary security and conservation of Barbados' agricultural plant biodiversity through the identification of plant pests and diseases and provision of environmentally sound control practices.

Millennium Development Goals

Barbados has adopted the Millennium Development Goals (MDGs). A full review of progress towards meeting these goals will not be presented in this report. However, Target 9 of Goal 7 of the MDGs is relevant to biodiversity as it requires integration of the principles of sustainable development into policies and programmes and reversing the loss of environmental resources. The indicators for environmental sustainability are (i)the proportion of land area covered by forest, (ii) percentage of area protected to maintain biological diversity,(iii) energy used (kg of oil equivalent per $1 000 of GDP), and (iv)carbon dioxide emissions per capita.

The progress towards meeting this target is difficult to assess, however from a biodiversity perspective. Barbados is moving to establish its Network of Protected Areas through its National Park Plan, which will see an increase in the areas under protection in the marine and terrestrial environment.

7.1.4 LINKAGES WITH OTHER UN CONVENTIONS

Climate change

Climate change will have an indirect impact on the islands' biodiversity. Increased sea temperatures will effect coral bleaching and have other deleterious impacts on near shore habitats and marine life. Terrestrial impacts will be felt in the agriculture industry affecting crop production and animal husbandry.

Desertification

Desertification is not only about the spread of deserts, but refers to land degradation in arid, semiarid and sub-humid climates. Land degradation is the persistent decrease in the supply of ecosystem goods and services as a result of changes in soil or vegetation, and includes deforestation and the effects of drought.

Barbados ratified the United Nations Convention to Combat Desertification (UNCCD) in 1997. A national action programme to combat land degradation and alleviate rural poverty has been developed. This action plan clearly recognizes and responds to the strong linkages between desertification, biodiversity and climate change, noting that Barbados should coordinate and have a synergistic approach to implementation of the three conventions.

7.1.5 CROSS-CUTTING PROGRAMMES AND PROJECTS

Fiscal incentives

CBD Article 11 requires each party, as far as possible and appropriate, to adopt economically and socially sound measures that act as an incentive for the conservation and sustainable use of biological resources. Some progress has been made by Barbados in this regard with the adoption and promotion of various economic instruments. Examples include the codification within the Coastal Zone Management Act of a regime for assessing damage to coral reefs. The legislation expressly provides the method and basis for calculating penalties for damage or destruction of coral reef. There is also Environmental Levy legislation whereby charges on levied on specified imported goods that may have a deleterious effect on the environment.

7.2 ECOSYSTEM APPROACH

7.2.1 OVERVIEW

The Government of Barbados adopted and is in the process of implementing the notion of the ecosystem approach that was endorsed at the 5th meeting of the Conference of the Parties to the CBD in 2000. The ecosystem approach as defined by the CBD refers to "a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. The ecosystem approach is consistent with the three objectives of the Convention: conservation; sustainable use; and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources".

7.3 MAINSTREAMING BIODIVERSITY IN LAND-USE PLANNING AND DECISION-MAKING

One of the most effective ways of mainstreaming biodiversity is through incorporating biodiversity concerns into planning and decision making at the appropriate levels. The land use and physical planning process provides a very useful platform for integrating principles of biodiversity protection and management. For mainstreaming to be effective, biodiversity needs to be an integral part of the planning and decision-making processes in the various spheres of government. This section briefly assesses the degree to which biodiversity considerations are included in land-use planning and decision-making in Barbados.

Since 1970 land use development in Barbados has been guided by the Physical Development Plan (PDP) which is a requirement of the Town and Country Planning Act, Chapter 240. The implementation of this policy has assisted the orderly development of the island while ensuring the protection and conservation of the environment. One aspect of the PDP relates to the establishment and protection of a National Park through balanced development.

The PDP therefore may be used to minimize the impacts of development on biodiversity (species, ecosystems, habitats. Another important planning tool has been the Environmental Impact Assessment (EIA) which was introduced through the physical development planning process in the 1980s and was formally adopted through amendments to the Town and Country Planning Act, Chapter 240 in 1998. Since them there has been a growing number of EIAs that have been prepared for major developments that seek to take environmental impacts into consideration prior to development.

8 PROGRESS TOWARDS THE 2010 TARGETS AND IMPLEMENTATION OF THE STRATEGIC PLAN

8.1 INTRODUCTION

This chapter presents the key findings from the previous chapters in order to assess how actions taken at the national level have contributed to achieving progress towards the 2010 targets. Table 8 also gives an indication of Barbados' progress towards implementing the CBD 2010 targets in detail.

8.2 CONCLUSIONS

The Government of Barbados' recognizes the importance of and remains committed to the management and conservation of its limited biodiversity resources. However, more work needs to be done to integrate these plans and programmes that are promoted by the NBSAP. This will give effect to the changes necessary to improve the management of biodiversity on the island while avoiding further degradation of natural habitats and loss of native species. In addition, a review of the NBSAP taking into consideration the work that has already been done to date and the current national policies, plans and programmes will be necessary in order to assess the relevance of the objectives as set out in the document and further implement the relevant provisions of the Convention. Further, the development of monitoring and assessment tools are necessary in order evaluate the progress and effectiveness of the conservation and management work being conducted on the island.

It is anticipated that the Government of Barbados will continue to pursue:

i. An integrated approach to ecosystem management
ii. Implementation of the National Park
iii. the implementation of all legislation that is currently in draft, particularly the Environmental Management Act and Draft Zoos Legislation; and
iv. the development of new legislation e.g. Barbados National Park Act
v. Enforcement of all existing and new legislation

These activities are critical to supporting and strengthening conservation and management measures. Going forward, the implementation of the National Park Plan and the management of alien invasive species will be the key areas of focus for the Natural Heritage Department as it continues to work toward the implementation of the Convention on Biological Diversity at the national level.

Table 8: Provisional Framework to Assess Progress Towards the 2010 Biodiversity Target

Goals and Targets	Relevant Indicators	Barbados' Progress
Protect the components of biodiversity		
Goal 1. Promote the conservation of the biological diversity of ecosystems, habitats and biomes		
Target 1.1: At least 10% of each of the world's ecological regions effectively conserved.	Coverage of protected areas Trends in extent of selected biomes, ecosystems and habitats Trends in abundance and distribution of selected species	The National Physical Development Plan makes provision for the establishment of a national system of parks and open spaces to ensure the protection and conservation of natural and cultural assets while supporting the socio-economic development of communities within the park boundaries. The following six open space categories have been recommended: • The Barbados National Park (OS1) • Natural Heritage Conservation Areas (OS2) • Coastal Conservation Zones (OS3) • Public Parks and Open Spaces (OS4) • National Attractions (OS5) • National Forest Candidate Sites(OS6) These areas designated as OS1, OS2, OS3, and OS6 contain several natural features that are supportive of natural habitats. They offer much scope in respect of the *in situ* conservation of biological diversity. The Barbados National Park Plan establishes policies to guide future land use and development within the boundaries of the National Park. The Natural Heritage Department continues to work on the implementation of National Park Development Plan The Folkestone Park and Marine Reserve was established in 1981 and to date remains the only legislated Marine Protected Area in Barbados. The Graeme Hall Swamp has been designated as a Ramsar site and this designation provides a national and international framework for the conservation of this area.

Target 1.2: Areas of particular importance to biodiversity protected	Trends in extent of selected biomes, ecosystems and habitats Trends in abundance and distribution of selected species Coverage of protected areas	Research continues to be done in an effort to monitor the abundance and distribution of key species and the extent of selected habitats and biomes by various agencies and organizations. The Physical Development Plan (PDP) (Amended 2003) makes provision for the establishment of a national system of parks and open spaces to ensure the protection and conservation of natural and cultural assets. These areas designated as OS1, OS2, OS3, and OS6 contain several natural features that are supportive of natural habitats. They offer much scope in respect of the *in situ* conservation of biological diversity. The Integrated Coastal Zone Management Plan (1998) has adopted turtle conservation measures identified by the Sea Turtle Recovery Action Plan for Barbados. A significant amount of work is currently being done by Government Departments, academia and non-governmental organizations in relation to coral reef and sea turtle conservation and management.
Goal 2. Promote the conservation of species diversity		

Target 2.1: Restore, maintain, or reduce the decline of populations of species of selected taxonomic groups.	Trends in abundance and distribution of selected species Change in status of threatened species	A significant amount of work is currently being done by Government Departments, academia and non-governmental organizations in relation to coral reef and sea turtle conservation and management. A number of taxon specific management plans have been developed which focus on the restoration maintenance and reduction in the decline of species of selected taxonomic groups e.g. The Fisheries Management Plan, Sea Turtle Recovery Action Plan. In addition, the implementation and enforcement of legislation has also contributed to the achievement of this target e.g. Moratorium on sea turtles and white sea urchins A significant amount of work needs to be done in order to implement the Integrated Gully Ecosystem Management Plan which recommends the Numerous biodiversity management Guidelines: • Forested gullies in which the majority of individual trees are native species should be protected from development • Gullies containing restricted range, rare species should be protected from development, inappropriate use, and from collection or extraction of fauna and flora for either personal or commercial purposes. • Strict enforcement of a 3 metre buffer zone which prohibits the clearing of any vegetation from the gully lip • Encouragement of the use of native species for landscaping gully sections • Introduction of known invasive species to gullies should be prohibited • Only minimal clearing of vegetation, including undergrowth, should in the establishment of infrastructural projects • The negative impacts (increased run-off, introduction of exotic and invasive species, increased light and noise, etc) of development on lands adjoining gullies should be minimized The implementation of these guidelines will contribute significantly to achieving this target.

Target 2.2: Status of threatened species improved.	Change in status of threatened species Trends in abundance and distribution of selected species Coverage of protected areas	This target is being addressed under Objective 3 of the NBSAP. The overall strategy is to establish a National Research Programme to document the status of threats to and value of biodiversity. In particular this objective requires action in terms of research on species and communities that are indigenous, rare or threatened, especially those requiring urgent protective measures. A significant amount of work has been done by the CZMU, the UWI and the BMT on coral reefs and marine turtles. Some work has also been done on plants through the UWI and the Ministry of the Environment's Gully Ecosystem Management Study. Further, the Biodiversity Work Programme of the MED has facilitated the monitoring of certain species such as the cattle egrets, queen conch and African Green Monkey over the years. Successive Fisheries Management Plans (from 2004 to present) also address the management of threatened species locally e.g. sea urchins and also to the management of *Strombus gigas* queen conch which is listed in CITES Appendix II. The various management plans that relate to species conservation and management are supported by pieces of legislation that seek to ensure natural resource protection e.g. International Trade in Endangered Species Act 2006-3, Wild Birds Protection Act Cap 398; The Fisheries Act 1993 Cap 391;Fisheries Management Regulations 1998; Draft Zoos Legislation; The Marine Pollution Control Act Cap 392A; The Coastal Zone Management Act (1998-39); National Conservation Commission Act 1982 cap 393; Protection of New Plant Varieties Act (2000-17); The Soil Conservation (Scotland District) Act cap 396; Trees (Preservation) Act cap 397; The Cultivation of Trees Act Cap 390; The Caves Act Cap 389; Land Acquisition Act cap 228; The Barbados Agricultural Development and marketing Corporation Act (12/1998); The Animals (disease and Importation) Act cap 253; Underground Water Control Act Cap 283
Goal 3. Promote the conservation of genetic diversity		

Target 3.1: Genetic diversity of crops, livestock, and of harvested species of trees, fish and wildlife and other valuable species conserved, and associated indigenous and local knowledge maintained.	Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socio-economic importance *Biodiversity used in food and medicine (indicator under development)* Trends in abundance and distribution of selected species	The Barbados Agricultural Society (BAS) secured grant funding from the GEF Small Grants Development Programme to undertake a study between 2008 and 2010 entitled "Conservation of the Genetic Makeup of the Barbados Blackbelly Sheep & Improvement of the Marketing Opportunities to the Industry. (BAR/SGP/OP4/CORE/08/04) "This project will assist the conservation of the genes of the Barbados Black Belly Sheep, an indigenous species to Barbados, through a strategy which engages small and poor farmers in their effective management. In the area of plant breeding, Barbados has a long history dating back to 1888 when scientific breeding of sugar cane began with the noble breeding programme through the west Indies Central Sugar Cane Breeding Station. Breeding has continued since then until now with the current emphasis on breeding efforts on the development of multi-purpose varieties that can produce sugar, ethanol (from juice or molasses) and surplus bagasse for electricity generation. Some areas of national plant breeding and associated biotechnology capacity are restricted to CARDI Barbados. This institute functions on behalf of the Ministry of Agriculture and works on hot pepper. The Cotton research and Development Unit, Ministry of Agriculture was created to assist with the institutional strengthening and support of the cotton industry through the provision of technical expertise, best practices in agriculture were developed and the best possible planting material were identified in an effort to propel the expansion of the industry towards full integration. Some of the Goals of the Unit include: • The maintenance of a Sea Island cotton genetic material that is higher yielding, more resistant to pests and diseases, and of higher lint quality; • To improve the yield and quality of Sea Island cotton through the use of optimum production practices and to introduce a cotton harvest technology which will facilitate increased daily harvest at a reduced cost without affecting lint quality.
Promote sustainable use		
Goal 4. Promote sustainable use and consumption.		
Target 4.1: Biodiversity-based	Area of forest, agricultural and aquaculture ecosystems under	Over the years there has been increased awareness among the Barbadian population as it relates to the importance and benefits of

products derived from sources that are sustainably managed, and production areas managed consistent with the conservation of biodiversity.	sustainable management *Proportion of products derived from sustainable sources (indicator under development)* Trends in abundance and distribution of selected species Marine trophic index, Nitrogen deposition, Water quality in aquatic ecosystems	Organic farming. In Barbados sixty-five organic farmers were registered under the Organic Growers and Consumers Association (OGCA), of these only fifteen are active. These farmers cultivate approximately sixty (60) acres of land and the majority of them focus primarily on organic crop agriculture. The Association's aim is to increase membership as well as the acreage of land under organic productionThe National Physical Development Plan (PDP) Amended 2003 sets out policies to guide relationships and competing interests among land uses.
Target 4.2. Unsustainable consumption, of biological resources, or that impact upon biodiversity, reduced.	Ecological footprint and related concepts	There has been a moratorium on the harvesting of sea eggs (*Tripneustes ventricosus*) for different periods since 1987 where no harvesting is allowed during closed periods. The Government of Barbados has developed legislation which prohibited the harvesting of all turtles since 1998. Other relevant legislation include the Trees (Preservation) Act and the Wild Birds Protection Act Cap 398 Act. Overall the legislation, plans and policies which the Government of Barbados have in place and are implemented through the work of a plethora of Government Departments and supported by the UWI as well as NGOs serve to assist in the reduction of unsustainable consumption.
Target 4.3: No species of wild flora or fauna endangered by international trade.	Change in status of threatened species	Barbados has been a Party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 1993. The International Trade in Endangered Species of Wild Fauna and Flora Act, 2006-3, passed in Parliament on February 7, 2006, in Section 5 (1) provides for the establishment of a Management Authority "for the purpose of establishing control over the international trade in any specimen listed in the Second Schedule. The NHD functions as the CITES Management Authority. Under the Act the Management Authority is responsible for issuing permits for the importation, exportation and re-exportation of endangered species of wild fauna and flora, maintaining records of trade, preparing annual reports, choosing rescue centres, consulting with the Scientific Authority, promoting public awareness and assessing the adequacy of importers. In Barbados, the Natural Heritage Department is the Management Authority. The NHD is

		therefore responsible for the issuance of permits. Permits are currently issued free of cost This target is being achieved through the implementation of sectoral plans. For example the Barbados Fisheries Management Plan recommends a number of selected management approaches in respect of Conch including Queen Conch (*Strombus gigas*), West Indian fighting conch (*S. pugilis*) and milk conch (*S. costatus*). These include: • Licensing of harvesters and vendors • Closed areas and seasons • Minimum shell size and or thickness of flared lip • Total, individual or allowable catch quotas In 2001 Government enacted the Protection of New Plant Varieties Act in response to its obligations as a member of the WTO and in particular as a party to the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). It addresses new and emerging issues such as the qualification of rights of plant breeders, their entitlement to protection and licenses. The Act also introduces criminal sanctions in respect of variety denomination.
Address threats to biodiversity		
Goal 5. Pressures from habitat loss, land use change and degradation, and unsustainable water use, reduced.		
Target 5.1. Rate of loss and degradation of natural habitats decreased.	Trends in extent of selected biomes, ecosystems and habitats Trends in abundance and distribution of selected species Marine trophic index	This target is being implemented through Objectives 3, 5 and 7 of the NBSAP and other sectoral plans such as the National Physical Development Plan (PDP) (Amended 2003), Coastal Zone Management Plan, the Integrated Gully Ecosystem Management Plan, and Water Resource Management Plan. Since 1970 the Government of Barbados has developed and implemented a comprehensive national land use plan which is reviewed and updated every five years. The Physical Development Plan (PDP) seeks to provide for the orderly and progressive development of land and for the preservation and improvement of related amenities. The PDP is an instrument that is used to guide relationships among land uses, community facilities and physical infrastructure. It allocates and designates land for the competing uses such as agricultural, open spaces and recreational areas, and urban

		development. principles as outlined in Section 1.0: • Emphasis on the protection of the natural environment and cultural heritage resources • Establishment of criteria and procedures for EIA • A national development strategy which aims to minimize the negative environmental and social impacts of scattered urban development, by concentrating new growth into a defined urban corridor • Protection of agricultural lands from incompatible urban development The PDP contains the following strategies: • the Government will ensure that agricultural practices are appropriate, sustainable and designed to protect and preserve natural resources • The government will promote research into new agricultural practices and technologies which will improve efficiency and profitability and minimize the negative impact of agricultural activity, notably the use of pesticides and herbicides, on the nation's natural resources The Sustainable Tourism Policy through Objective 10.2 seeks to promote sustainable tourism development through the protection, conservation and development of the natural environment within its carrying capacity and through education and awareness of and respect for the island's unique natural heritage. The Government of Barbados has formulated a Sustainable Water Management Strategy and Action Plan which has identified the following strategies:
Goal 6. Control threats from invasive alien species		
Target 6.1. Pathways for major potential alien invasive species controlled.	Trends in invasive alien species	A considerable amount of research and work is done in the control of threats of invasive species especially those which affect the agriculture sector. Research is This target is being implemented under Objective 3 of the NBSAP. The NBSAP calls for the following actions: • Research on the presence, distribution and abundance of alien and genetically modified species and the development

		of a GIS compatible database • Development/support of monitoring projects designed to assess impacts of exploitation, habitat loss, pollutants and alien species on the distribution and abundance of terrestrial, marine and freshwater biodiversity, alien, indigenous and rare species Objective 9 of the NBSAP calls for action to be taken to develop and implement ecosystem rehabilitation activities and recovery plans including the removal of alien species and replacement with indigenous species. The Integrated Gully Ecosystem Management Plan includes biodiversity conservation strategies that require the following actions: When permission to landscape/develop a gully section is given, native species should be used wherever possible and exotic plants (excluding known invasive species) used sparingly • as accent plants only • Introduction of known invasive species to gullies should be prohibited To guard against potential invasive species, exotics that must be planted on the edges or within gullies should not be plants that are easily propagated vegetatively
Target 6. 2. Management plans in place for major alien species that threaten ecosystems, habitats or species.	Trends in invasive alien species	The Barbados Primate Centre operates a Monkey Crop Damage Control Programme, whereby problem animals are humanely trapped. Additionally, the Ministry of Agriculture has instituted a national programme to address the issue of the Giant African Snail. Current measures include: • A National Public Education and Sensitization Programme that includes Convening Town Hall meetings, presentations to schools and community groups etc. and a hotline for persons sighting the snails to call in and report it. • Baiting of snails by the Ministry of Agriculture and Rural Development, sectors and private individuals who receive limited amounts of bait free from the Ministry.

		• A Quarantine Unit at ports of entry However, a comprehensive monitoring programme needs to be developed in order to evaluate the effectiveness of the measures being undertaken With respect to the control of rodents, there is a national vector control programme that is administered by the Environmental Health Departments of the Ministry of Health through the Polyclinics. The programme focuses on Government institutions and property and responds to complaints from the public. In addition, a national Integrated Rodent Control Programme is being developed that includes the involvement of all major stakeholders including the Ministry of Health, Barbados Chamber of commerce and Industry, the Barbados Hotel and Tourism Association, the Sugar produces and members of the private sector. The aim is to implement a comprehensive programme to reduce rodent populations and impacts.
Goal 7. Address challenges to biodiversity from climate change, and pollution		
Target 7.1. Maintain and enhance resilience of the components of biodiversity to adapt to climate change.	Connectivity/fragmentation of ecosystems	The Government of Barbados is a party to the UNFCCC and the Kyoto Protocol and has developed a national climate change work programme and a multidisciplinary steering committee to oversee the implementation of the provisions of the UNFCCC and the Kyoto Protocol at the national level. The National Climate Change and Adaptation Policy and Abatement Plan once developed will foster and guide a national process for avoiding, minimizing and adapting to climate change effects over the short to long term and to do this in a coordinated, holistic and participatory manner in order to ensure that the quality of life of the people of Barbados and opportunities for sustainable development are not compromised. One of the objectives of the policy is to "Foster the development of processes, plans, strategies and approaches to: avoid, minimize or adapt to the negative impacts of climate change on Barbados' natural environment, including ecosystems, species, genetic resources, ecological processes, lands and water. It is also recognized that within the plan that the development and application of legal and institutional systems and management mechanisms for planning for and responding to climate change would also be necessary. In addition, the National Climate Change and Adaptation Policy identifies activities that the Government of Barbados in collaboration

		with other relevant entities must employ to address impacts of climate change on coastal marine resources, these are as follows: • Strengthen the capacity the CZMU to continue and expand its programme for coastal monitoring and data collection activities in order to improve decision making • Promote and facilitate ongoing assessment of the health of coastal resources and the identification of those at risk and, where necessary: • Adopt short, medium and long term measures to protect coastal lands and to increase the resilience of coastal ecosystems and resources, including the construction of coastal defence structures, enforcement of setbacks, floor elevations and restoration of coastal wetlands • Undertake the restoration of damaged or destroyed coastal resources and coastal ecosystems, such as sand dune systems, coral reefs, seagrass beds, and mangroves, where possible and technically feasible This target will also be implemented through the implementation of the NBSAP objectives and activities within the various sectoral plans.
Target 7.2. Reduce pollution and its impacts on biodiversity.	Nitrogen deposition Water quality in aquatic ecosystems	Government has recently enacted two major pieces of environmental legislation to prevent, reduce and control pollution in the marine environment of Barbados: (1) The Marine Pollution Control Act (MPCA) and (2) The Coastal Zone Management Act (CZMA). The MPCA addresses all waste disposal and discharges in Barbados that could impact on the marine water quality. Oil Spills Protocol that involves the major private sector companies (e.g. oil companies), government and other major stakeholders (tourism, landowners etc.) has been implemented to address possible pollution of the environment. There are periodic emergency drills staged to test levels of preparedness and response. The CZMA provides for the more effective management of the coastal resources of Barbados for the conservation and enhancement of those resources. 1998 Environmental Management and Land Use Planning (EMLUP) for sustainable development project resulted in the following output documents; Draft Environmental Management Act, Draft Environmental Management Plan, Draft Environmental and Natural Resources Management Plan, National Park and Development Plan,

		Revised Physical Development Plan, The Physical Development Plan contains the following strategy: • The Government will promote research into new agricultural practices and technologies which will improve efficiency and profitability and minimize the negative impact of agricultural activity, notably pesticides and herbicides on the nation's natural resources. • Applications for a number of specified types of development require the preparation and submission of EIAs • All lands in Barbados have been divided into five water protection zones aimed at restricting development and waste disposal practices. The PDP sets out certain policy objectives aimed at maintaining and strengthening ground water protection policy. The draft Solid Waste Management Act will provide a comprehensive framework for the management of solid waste. Government has developed an Integrated Solid Waste Management Programme. One of the main pillars of the programme is sustainable practices that encourage waste reduction, re-use and recycling. The Integrated Solid Waste Management Programme will provide for the construction of a Chemical Waste Storage facility. Government, under the chairmanship of the Environmental Unit is in the process of preparing a chemical and hazardous substances policy. The Marine Pollution Control Act, 1998-40 was implemented to prevent, reduce and control pollution of the marine environment of Barbados from: Land Based sources, Sea bed-bed activities, Dumping activities and Air pollution. Marine Pollution Section of the EPD which was established in 2000, and works closely with the CZMU to regulate activities and development that may impact negatively on the marine environment. These departments use the MPCA and the Coastal Zone Management Act 1998 (CZMA) as the main legal instruments to assist in the conservation and regulation of marine environmental quality and coastal marine resources.
Maintain goods and services from biodiversity to support human well-being		

Goal 8. Maintain capacity of ecosystems to deliver goods and services and support livelihoods		
Target 8.1. Capacity of ecosystems to deliver goods and services maintained.	*Biodiversity used in food and medicine (indicator under development)* Water quality in aquatic ecosystems, Marine trophic index, Incidence of Human-induced ecosystem failure	The Fishing Industry continues to make a significant contribution to the nutritional, economic and social well being of the population in Barbados. The NBSAP confirms that the local marine and freshwater ecosystems support many habitats where a diverse collection of aquatic organisms interact with each other. However the marine and possibly the freshwater ecosystems are under stress as a result of terrestrial run off. The enforcement of the Marine Pollution Control Act Cap 392.
Target 8.2. Biological resources that support sustainable livelihoods, local food security and health care, especially of poor people maintained.	Health and well-being of communities who depend directly on local ecosystem goods and services *Biodiversity used in food and medicine*	This target is being implemented through a number of sectoral plans and policies Including: • The Integrated Coastal Zone Management Plan • The Integrated Gully Ecosystem Management Plan • Draft Physical Development Plan 2003 • NBSAP • State of the Environment Report • Barbados Sustainable Development Policy • The Sustainable Tourism Policy • Fisheries Management Plan (2004-2006) • Agricultural Area Development Plan
Protect traditional knowledge, innovations and practices		
Goal 9 Maintain socio-cultural diversity of indigenous and local communities		
Target 9.1. Protect traditional knowledge, innovations and practices.	Status and trends of linguistic diversity and numbers of speakers of indigenous languages *Additional indicators to be developed*	The NBSAP recognizes and calls for the documentation of research on indigenous knowledge, innovations and practices with respect to utilization of biodiversity, for example medicinal plants. Objective 5 of the NBSAP calls for : • The formulation of national legislation to address biodiversity access and benefit sharing The Biodiversity Enabling Activities Project includes a component on this.
Target 9.2. Protect	*Indicator to be developed*	The NBSAP recognizes and calls for the documentation of research

the rights of indigenous and local communities over their traditional knowledge, innovations and practices, including their rights to benefit sharing.		on indigenous knowledge, innovations and practices with respect to utilization of biodiversity, for example medicinal plants. Objective 5 of the NBSAP calls for : • The formulation of national legislation to address biodiversity access and benefit sharing The Biodiversity Enabling Activities Project includes a component on this.
Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources		
Goal 10. Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources		
Target 10.1. All access to genetic resources is in line with the Convention on Biological Diversity and its relevant provisions.	*Indicator to be developed*	Barbados does not have significant problems as it relates to access and benefit sharing and has maintained compliance with the related Articles of the CBD. The Natural Heritage Department is the designated authority responsible for biodiversity and traditional knowledge access.
Target 10.2. Benefits arising from the commercial and other utilization of genetic resources shared in a fair and equitable way with the countries providing such resources in line with the Convention on Biological Diversity and its	*Indicator to be developed*	Barbados does not have significant problems as it relates to access and benefit sharing and has maintained compliance with the related Articles of the CBD. The Natural Heritage Department is the designated authority responsible for biodiversity and traditional knowledge access.

relevant provisions		
Ensure provision of adequate resources		
Goal 11: Parties have improved financial, human, scientific, technical and technological capacity to implement the Convention		
Target 11.1. New and additional financial resources are transferred to developing country Parties, to allow for the effective implementation of their commitments under the Convention, in accordance with Article 20.	Official development assistance provided in support of the Convention	
Target 11.2. Technology is transferred to developing country Parties, to allow for the effective implementation of their commitments under the Convention, in accordance with its Article 20, paragraph 4.	*Indicator to be developed*	

APPENDIX I REPORTING PARTY

Contracting Party	
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Signature of officer responsible for submitting national report	
Date of submission	

APPENDIX IB – NATIONAL REPORT PREPARATION

The Natural Heritage Department (NHD), Ministry of Environment, Water Resources and Management **(MED)** engaged a Consultant to prepare the Fourth National Report. Technical support was provided by the United Nations Environment Programme through UNEP Nairobi. The NHD played a facilitative role in the preparation of this report and was responsible for providing the necessary background information, liaising with relevant stakeholders and through its Working Group on Biodiversity provided a peer review mechanism to ensure the necessary quality assurance of the report.

During the initial preparation stage particular attention was given to information contained in key existing documents and reports such as the National Biodiversity Strategy and Action Plan (NBSAP); Barbados' First, Second and Third National Reports to the CBD, Barbados National Thematic Report on Protected Areas. Rapid assessment and peer reviews were used to assist with data collection and collation.

The Consultant held an initial meeting with officials from the national executing agency, The Natural Heritage Department to discuss the Terms of Reference and to ensure that both parties were clear as to the objectives and expected outputs of the project. Following this meeting, an inception report was prepared and submitted by the consultants to the NHD. The consultants then set about compiling and reviewing all necessary documents that would be used to inform the report. A focus group meeting with key stakeholders was held on Tuesday 12th October, 2010 at Almond Bay, Hastings, Christ Church at 9:30 a.m. The objectives of this meeting were to:

1. share information on the draft Barbados Fourth National Report;
2. receive comments and inputs on the draft sections of the report
3. allow stakeholder participation.

Participants were asked to make input on issues concerning the status, trends and threats concerning biodiversity, the current status of the National Biodiversity Strategy and Action Plan, and Sectoral and cross-sectoral integration or mainstreaming of biodiversity. The information from the focus group was then used to update and supplement the information obtained from the literature review.

The document was finalized and submitted to the Natural Heritage Department for final submission to the CBD Secretariat.

Information from the following stakeholders was considered important to the preparation of this report and these entities were invited to attend consultations and to contribute information:

Public Sector

- Ministry of Environment and Drainage
  - Environment Unit
  - Coastal Zone Management Unit
  - National Conservation Commission
  - Environmental Special Projects Unit
  - Botanical Gardens Project Unit

    - Barbados Water Authority

- Ministry of Agriculture and Rural Development
    - Fisheries Division
    - Veterinary Services
    - Plant Quarantine
    - Soil Conservation
- Town and Country Development Planning Office
- National Council for Science and Technology
- Barbados Agricultural Development Management Company

Non-Governmental Organizations

- Barbados National Union of Fisherfolk
- Caribbean Youth Environmental Network
- West Indies Central Sugarcane Breeding Station
- Barbados Marine Trust
- Barbados Environmental Society
- Barbados Agricultural Society

Community Based Organizations

- Organic Growers/Consumer Association
- Barbados Sheep Farmers Association

Academic and Others

- University of the West Indies
    - Centre for Resource Management and Environmental Studies (CERMES)
    - Department of Biological and Chemical Sciences
- Caribbean Agriculture and Resource Development Institute (CARDI)

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Table 9: Progress Towards the Global Strategy for Plant Conservation

Target No.	Target	Progress Highlighted in the Third National Report	Progress Made Between 2005 and 2010 – The Fourth National Report Period	Obstacles	Needs and Future Priorities
1	**A widely accessible working list of known plant species, as a step towards a complete world flora.**	No national target has been established that corresponds to the global target. However, The Biodiversity Conservation subcomponent of the Barbados Gully Ecosystems Management Study provided a partial assessment of the biota of Barbados which focused on the gully ecosystem. A wide range of information on the biota of Barbados gullies was collected during broad-scale surveys and in-depth studies of biodiversity at 24 selected sites. The broad-scale surveys collected information on vegetation category, dominant plants and shrubs, invasive species, and fruit trees. During the study plant transects were undertaken in 630 gully segments where some 24 species of shrubs and 47 species of trees were	An online database of all known plants on the island has been developed[71] The MED responsibility for the gully management sub-programme will reside with the Natural Heritage Department (NHD). This shift is consistent with the recommendations contained in the Integrated Gully Ecosystems Management Plan (IGEMP) and recognizes the umbrella responsibility of the NHD for Biodiversity matters.	Human resource constraints within the Environmental Unit of the MED to fully effect the programme, and limited financial resources	Success in the utilization of Gullies as a national natural resource asset will require recognition and take up of responsibilities identified in the Integrated Gully Ecosystems Management Plan, and Gully Management Implementation plan, by the various Public Sector offices that have jurisdiction in gully management.

[71] Broome, R., Sabir, K., Carrington, S. 2007, *Plants of the Eastern Caribbean* **http://ecflora.cavehill.uwi.edu/index.html**

		recorded. There are approximately 348 km of wooded gullies in Barbados that may be classified into four broad categories: • Closed forest • Open forest • Scattered trees • Thicket Two main plant assemblages have been identified: (1) moist forest (semi-evergreen to evergreen seasonal forest); (2) dry forest (deciduous seasonal) The Integrated Gully Ecosystem Management Plan includes a number of strategies and guidelines that will facilitate the achievement of this target: • Establish gully conservation system • Land Use Guidelines Biodiversity Conservation Guidelines The measures in place that could facilitate the achievement of this target include: the preparation of various action plans including: • The Integrated Gullies Ecosystem Management			

		Plan • The Integrated Coastal Zone Management Plan • The Physical Development Plan • The Agricultural Area Development Plan • The Sustainable Tourism Policy Other measures include: • The Protection of Plant Variety Act • Trees Preservation Act • Soil Conservation (Scotland District) Act			
2	**A preliminary assessment of the conservation status of all known plant species, at national, regional and international levels**	The Biodiversity Conservation subcomponent of the Barbados Gully Ecosystems Management Study provided a partial assessment of the biota of Barbados which focused on the gully ecosystem. A wide range of information on the biota of Barbados' gullies was collected during broad-scale surveys and in-depth studies of biodiversity at 24 selected sites. The broad-scale surveys collected information on vegetation category, dominant plants and shrubs,	An assessment of the conservation status of all known plant species, as far as possible has been done and this can be used to guide conservation activities		

		invasive species, and fruit trees. During the study plant transects were undertaken in 630 gully segments where some 24 species of shrubs and 47 species of trees were recorded. There are approximately 348 km of wooded gullies in Barbados that may be classified into four broad categories: • Closed forest • Open forest • Scattered trees • Thicket Two main plant assemblages have been identified: (1) moist forest (semi-evergreen to evergreen seasonal forest); (2) dry forest (deciduous seasonal)			
3	**Development of models with protocols for plant conservation and sustainable use, based on research and practical experience**	The Biodiversity Subcomponent of the Gully Ecosystem Management Study has established a methodology for conducting in-depth surveys of the biota in gullies. This approach may be used for subsequent studies and long term monitoring of terrestrial biota. Government is in the process of developing plans for the establishment of a national botanical garden. Indicators are being developed. The national botanical garden is	Information, research and associated outputs and; the methods necessary to implement the Strategy have been developed and shared National Botanical Garden Project Office has been established. Work on the establishment of the garden is ongoing.		

		expected to be opened by 2007.			
4	**At least ten percent of each of the world's ecological regions effectively conserved.**	Through accession to the Ramsar Convention which focuses on the conservation of wetland habitats. Barbados intends to designate the Graeme Hall Swamp which is the largest remaining wetland of its kind on the island as its first Ramsar site.	Graeme Hall swamp was designated as a RAMSAR site on 12/12/2005.		
5	**Protection of fifty percent of the most important areas for plant diversity assured.**	All the possible areas for plant diversity in Barbados have been identified and incorporated into different sectoral plans such as: • The Integrated Gully Ecosystem Management Plan • The Integrated Coastal Zone Management Plan • The Physical Development Plan The Sustainable Tourism Policy Some measures include: • Enactment of certain pieces of legislation such as the Coastal Zone Management Act • Preparation and revision of key action plans such as the Physical Development Plan, Agricultural Area Development Plan,			

		Integrated Gully Ecosystem Management Plan • Lack of appropriate legal and regulatory framework • Lack of appropriate governance structure – existing framework is uncoordinated and fragmented • Lack of appropriate institutional arrangements – for example the lack of a lead agency to oversee biodiversity conservation such as a Natural Heritage Unit • Lack of data and information Most of the plant diversity areas fall within "paper" conservation areas that have not been legally designated Measures taken to achieve the target include: • Enactment of certain pieces of legislation such as the Coastal Zone Management Act • Preparation and revision of key action plans such as the Physical Development			

		Plan, Agricultural Area Development Plan, Integrated Gully Ecosystem Management Plan			
6	**At least thirty percent of production lands managed consistent with the conservation of plant diversity.**	The target has been incorporated into several plans, programmes, policies and strategies including: • Physical Development Plan • Agricultural Area Development Plan • Integrated Coastal Zone Management Plan Integrated Gully Ecosystem Management Plan		Lack of appropriate legal and regulatory framework Lack of appropriate governance structure – existing framework is uncoordinated and fragmented Lack of appropriate institutional arrangements – for example the lack of a lead agency to oversee biodiversity conservation such as a Natural Heritage Unit Lack of data and information	
7	**Sixty percent of the world's threatened species conserved *In-situ*.**				
8	**Sixty percent of threatened plant species**				

	in accessible *Ex-situ* collections, preferably in the country of origin, and 10 percent of them included in recovery and restoration programmes.				
9	**Seventy percent of the genetic diversity of crops and other major socio-economically valuable plant species conserved, and associated indigenous and local knowledge maintained.**	Sugar varieties maintained at the Sugar Cane Breeding station. Plant species e.g. Mango are maintained at the proposed National Botanic Gardens at Waterford. Barbados Herbarium, UWI Cave Hill contains floral genes. CARDI contains pepper genes. The Cotton research and Development Unit, Ministry of Agriculture is working toward the establishment of an integrated mechanism of cotton research and the maintenance of Sea Island cotton genetic material that is higher yielding, more resistant to pests and diseases, and of higher lint quality			
10	**Management plans in place for at least 100 major alien species that threaten**				

	plants, plant communities and associated habitats and ecosystems.				
11	**No species of wild flora endangered by international trade.**	Some 700 species of flowering plants have been identified in Barbados with only two being considered as endemic and neither is deemed to be rare or endangered: *Phyllanthus andersonii* – a gully shrub; and *Metastelma barbadense* – a slender climber. The NBSAP records that there are some 23 plants in Barbados that require protection. The Government of Barbados is a party to CITES and has established a Management Authority and Scientific Authority to assist with the implementation of the convention. Government has also prepared draft CITES legislation which will be enacted shortly. Apart from the research done on flowering plants there is a lack of data on most other plants in Barbados.			
12	**Thirty percent of plant-based products**				

	derived from sources that are sustainably managed.				
13	**The decline of plant resources, and associated indigenous and local knowledge, innovations and practices that support sustainable livelihoods, local food security and health care, halted.**	The Biodiversity Subcomponent of the Gully Ecosystem Management study offers valuable information on the ecological value of gully biodiversity. Gully ecosystems in Barbados provide habitats for woodland wildlife that is in short supply elsewhere in the island. Several of the gully biological resources have economic value including animal food, traditional medicines, handicrafts, and biomedical research. The extractive value of gully biodiversity may not be as great as its existence and in situ value since the gully biodiversity performs invaluable ecosystem services which may be used for passive recreational, educational and eco-tourism purposes. The NBSAP has identified the main sources of impacts on the vegetation biodiversity as development, in particular tourism development; and uncontrolled grazing from livestock. One of the potential threats is alien invasive		Lack of research and information	

		species but this matter has not been properly assessed. The NBSAP has identified an information gap in respect of indigenous communities and peoples. Traditional knowledge in terms of the sustainable use of biodiversity has not been adequately researched. This has resulted in a dearth of information on traditional knowledge. The Integrated Gully Ecosystem Management Plan provides various strategies that may facilitate the achievement of this target.			
14	**The importance of plant diversity and the need for its conservation incorporated into communication, educational and public-awareness programmes**	Reference 15 of the Integrated Gully Ecosystem Management Plan focuses on developing a public awareness and participation strategy which requires the following actions: • Integrate gully information into the school curriculum • Enhance and continue non-formal education programmes and activities that will build public awareness of these systems			

		• Develop programmes to educate farmers and agriculturalists on the impacts of various farming practices on gullies including pesticides use and soil conservation methods Objective 8 of the NBSAP seeks to improve public awareness and education. Several actions have been identified including: • Involving the Ministry of Education in the planning and execution of educational and public awareness activities • Disseminating information on biodiversity issues to all educational institutions (primary, secondary, tertiary) • Training teachers to teach courses on the topics of biodiversity conservation and sustainable use • Incorporating studies on the environment into the school curricula • Provide scholarships for tertiary level studies in fields related to			

		biodiversity management including taxonomy, ecology, and biotechnology • Creating a web site on biodiversity issues, concerns and action plans for Barbados • Encouraging tree-planting schemes along roads, in new developments • Conducting community workshops on biodiversity conservation and sustainable use • Conducting workshops for other stakeholders including hotels and the tourism sector			
15	**The number of trained people working with appropriate facilities in plant conservation increased, according to national needs, to achieve the targets of this Strategy.**	Objective 8 of the NBSAP calls for the following: • Involving the Ministry of Education into the planning and execution of educational and public awareness activities • Disseminating information on biodiversity issues to all educational institutions (primary, secondary, tertiary)			

		• Training teachers to teach courses on the topics of biodiversity conservation and sustainable use • Incorporating studies on the environment into the school curricula • Providing scholarships for tertiary level studies in fields related to biodiversity management including taxonomy, ecology, and biotechnology Other sectoral plans and policies have incorporated public awareness and education strategies, including: • The Coastal Zone Management Plan • The Physical Development Plan • The Agricultural Area Development Plan • The Integrated Gully Ecosystem Management Plan			
16	**Networks for plant conservation activities established or**	The Government has incorporated this target into relevant plans and programmes Government has established a National Arbor Day Committee	**The multi-sectoral committees continue to work and play an active role in the implementation of respective work programmes.**		

	strengthened at national, regional and international levels.	which includes members from government, non-government organizations, community based organizations and the academic community. With respect to the proposed National Botanical Gardens, multi-disciplinary and multi-sectoral committees have been established to spearhead to establishment of the garden. Additionally, Barbados is a party to the United Nations Convention to Combat Desertification and Drought. It is in the process of implementing the provisions of the Convention which includes: • The creation of a national technical focal point; • An inter-ministerial and multi-disciplinary committee to provide technical oversight; The preparation of draft National Action Plan which includes strategies to combat land degradation through *inter alia* tree planting and other sustainable land management strategies. The Arbor Day Committee organizes annual tree planting events and general public			

		awareness and education activities. A national consultation on the proposed Botanic Garden was convened. Baseline surveys on the initiative are currently being undertaken.			

APPENDIX IV – PROGRESS TOWARDS ACHIEVING THE PROGRAMME OF WORK ON PROTECTED AREAS

The Thematic Report on Protected Areas 2003 states that the overall aim of the programme of work on protected areas is to support the establishment and maintenance by 2010 of terrestrial areas and by 2012 of marine areas that are: comprehensive, effectively managed, and ecologically representative of national and regional systems of protected areas. These systems should collectively, *inter alia* through a global network, contribute to achieving the three objectives of the Convention and the 2010 target to significantly reduce the current rate of biodiversity loss at the global, regional, national and sub-national levels and; contribute to poverty reduction and the pursuit of sustainable development, thereby supporting the objectives of the Strategic Plan of the Convention, the World Summit on Sustainable Development Plan of Implementation and the Millennium Development Goals.

The Ministry of Environment and Drainage (MED) considers the development of a national system of protected areas to be integral to biodiversity conservation and management and overall sustainable development. The Natural Heritage Department (NHD) has been charged with the mandate for establishing Barbados' first system of Protected Areas, specifically through the development of a National Park (NP), the boundaries of which have been delimited.

The National Park Development Plan proposes a range of projects to guide the development of the Barbados National Park and Natural Heritage Conservation Areas for Barbados. The plan utilizes an ecosystem approach to the National Park Planning Process for Barbados and recognizes the dynamics and resilience of ecosystems and their limits.

At the time of reporting, the NHD's work in relation to the designation of Barbados' first National Park commenced in 2009. This work involved utilising methodologies that include the following: a) visual assessment work via field investigation and photographs of the Barbados National Park; b) review of all documentation generated from previous work (studies) carried out of the proposed National Park; c) production of booklet and CD of National Park related information; and d) Establishment of the National Park Advisory Committee.[72]Table 10 shows some of the progress made by Barbados in achieving the goals and targets of the Programme of Work on Protected Areas.

[72] Government of Barbados, Ministry of the Environment, Water Resources and Drainage, 2009, *Economic and Social Report of the ministry of the Environment, Water Resources and Drainage*

Table 10: Progress Made Towards Achieving the Programme of Work on Protected Areas

Goals	Target	Progress Made
1.1. To establish and strengthen national and regional systems of protected areas integrated into a global network as a contribution to globally agreed goals.	By 2010, terrestrially and 2012 in the marine area, a global network of comprehensive, representative and effectively managed national and regional protected area system is established as a contribution to (i) the goal of the Strategic Plan of the Convention and the World Summit on Sustainable Development of achieving a significant reduction in the rate of biodiversity loss by 2010; (ii) the Millennium Development Goals – particularly goal 7 on ensuring environmental sustainability; and (iii) the Global Strategy for Plant Conservation	More work has been done at the national level than at the regional level to date in this area. However, NHD was established in 2005 and has been charged with the mandate for establishing Barbados' first system of Protected Areas, specifically through the development of a National Park, the boundaries of which have been delimited. The National Park Development Plan proposes a range of projects to guide the development of the Barbados National Park as well as the proposed Natural Heritage Conservation Areas. In addition, the plan proposes an ecosystem approach to the National Park Planning Process and recognizes the dynamics and resilience of ecosystems and their limits. However, to date the National Park has not been legally established. The Folkestone Park and Marine Reserve (FPMR) was established in 1981 by the Designation of Restricted Areas Order 1981, and the Marine Areas (Preservation and Enhancement) (Barbados Marine Reserve) Regulation 1981 and is managed by the National Conservation Commission (NCC). FPMR was Barbados' first marine protected area. It remains the only protected area to be formally established by legislation on the island. The Government of Barbados undertook a feasibility study in 1998 to determine the administrative, technical and financial feasibility of further development of Harrison's Cave and assess the feasibility of establishing an Integrated Nature Tourism Area (INTA), which incorporates the

		surrounding natural areas to protect and conserve the ecology of the cave and the natural environment of the area. A significant amount of work has been done in this area. The NHD concluded the coordination of Phase III of the Capital Works Programme on 31 August 2000. The project encompassed *inter alia*: a) Builders and Civil Works; b) Renewable Energy; c) Landscaping and site design; d) Contract Administration; e) Community Participatory Processes; f) Interpretative Designs; g) Geotechnical Stability Study; h) Approval by The Cabinet for acquisition of land; i) Preliminary Works for Road Improvement Project. Carlisle Bay and the Rockley Breakwater[73] have also been proposed as marine protected areas. However, these have not been legislated.
1.2. To integrate protected areas into broader land- and seascapes and sectors so as to maintain ecological structure and function.	By 2015, all protected areas and protected area systems are integrated into the wider land- and seascape, and relevant sectors, by applying the ecosystem approach and taking into account ecological connectivity [5]/ and the concept, where appropriate, of ecological networks.	The National Physical Development Plan (PDP) (Amended 2003) for Barbados sets out policies to guide relationships and competing interests among land uses, community facilities and physical infrastructure. The PDP details the Barbados system of Parks and Open Spaces, the goal of which is to promote landscape preservation, ensure the conservation of natural areas, meet the active and passive recreation needs of residents of Barbados and enhance amenities for residents and tourist alike. The system also seeks to establish a National Park which will protect and conserve the natural and cultural assets of the area

[73] www.coastal.gov.bb

[5]/ The concept of connectivity may not be applicable to all Parties.

		while supporting the social and economic development of existing communities within the park boundaries The PDP details a system of Parks and Open Spaces for Barbados, which has six categories and also details specific land use policies for each of the categories. The National Park Plan also makes recommendations on the need for a new National Parks Act as well as the administrative and organizational structure necessary. The Coastal Zone Management Act, 1998-39, allows for the provision of more effective management of the coastal resources of Barbados, for the conservation and enhancement of those resources and for related matters such as giving the Coastal Zone Management Unit the power to recommend for the approval of the Minister designated marine areas as restricted areas for the following purposes: i. the preservation or enhancement of the natural beauty of the areas; ii. the protection or rehabilitation of the flora and fauna found in the areas; iii. the protection of wrecks and other items of archaeological and historical interest found in the areas; iv. the promotion of the enjoyment by the public of the areas; v. the promotion of the scientific study and research in respect of the areas. The Carlisle Bay Feasibility study makes many recommendations for legislation, amendments to existing legislation and regulations, as does the

		Folkestone study. At the time of reporting, the NHD preliminary work in relation to the designation of Barbados' first National Park commenced in 2009. This work involved utilising methodologies that include the following: a) visual assessment work via field investigation and photographs of the Barbados National Park; b) review of all documentation generated from previous work (studies) carried out of the proposed National Park; c) production of booklet and CD of National Park related information; and d) Establishment of the National Park Advisory Committee.[74] The NHD continues to work toward this goal.
1.3. To establish and strengthen regional networks, transboundary protected areas (TBPAs) and collaboration between neighbouring protected areas across national boundaries.	Establish and strengthen by 2010/2012 [6]/ transboundary protected areas, other forms of collaboration between neighbouring protected areas across national boundaries and regional networks, to enhance the conservation and sustainable use of biological diversity, implementing the ecosystem approach, and improving international cooperation	UNEP/CEP/Sida/CaMPAM. 2008 Caribbean MPA-A database of the Wider Caribbean's Marine Protected Areas. http://cep.unep.org/caribbeanmpa//recently_modified .Last accessed, 28th May 2008. FPMR is listed in a database which was established as part of the Caribbean Marine Protected Area Management (CaMPAM) Network and Forum activities. The aim of the Network is to provide detailed and standardized information on protected areas located in the coastal areas of the 34 countries and territories that are part of the Wider Caribbean or Tropical Northwestern Atlantic Coastal Biogeographic Province. This activity includes the compilation and

[74] Government of Barbados, Ministry of the Environment, Water Resources and Drainage, 2009, *Economic and Social Report of the Ministry of the Environment, Water Resources and Drainage*

[6]/References to marine protected area networks to be consistent with the target in the WSSD plan of implementation.

		dissemination of information as well as the generation of analytical products that can assist managers and academia to better understand the MPA scenario in the Wider Caribbean. Information on the geographic location and size, physical description, legal aspects and management is provided.[75]
1.4. To substantially improve site-based protected area planning and management.	All protected areas to have effective management in existence by 2012, using participatory and science-based site planning processes that incorporate clear biodiversity objectives, targets, management strategies and monitoring programmes, drawing upon existing methodologies and a long-term management plan with active stakeholder involvement	The FPMR was established in 1981 by the Designation of Restricted Areas Order 1981, and the Marine Areas (Preservation and Enhancement) (Barbados Marine Reserve) Regulation 1981 and is managed by the National Conservation Commission (NCC). The NHD has responsibility for the implementation of the National Park Plan and work remains ongoing in this area. Carlisle Bay is presently designated as a Marine Protected Area. The formal establishment of Carlisle Bay as a recreational park and marine reserve through legislation remains ongoing process.
1.5. To prevent and mitigate the negative impacts of key threats to protected areas.	By 2008, effective mechanisms for identifying and preventing, and/or mitigating the negative impacts of key threats to protected areas are in place.	The Reef Watchers programme is a community-based coral reef monitoring regime that was implemented at the Folkestone Marine Reserve to facilitate the development of a coral reef monitoring database. The programme involves local divers that will be working together with scientists to monitor reefs adjacent to the reserve. Monitoring within the Reserve allows managers to detect changes earlier and as a result develop plans/strategies to minimize impacts.

[75] http://www.cavehill.uwi.edu/cermes/Folkestonepub/FMR_Annotated_bibliography_May_2008.pdf

		The existence and enforcement of legislation also acts as a deterrent to persons who may wish to engage in activities that are prohibited within the protected areas e.g. fishing.
2.1. To promote equity and benefit-sharing.	Establish by 2008 mechanisms for the equitable sharing of both costs and benefits arising from the establishment and management of protected areas	A Community-based Coral Reef Monitoring and Management project was developed by the Caribbean Conservation Association in order to strengthen the participation and capacity of stakeholders to improve management of coral reef biodiversity and related resources at Folkestone Marine Reserve.[76] The National Park and Carlisle Bay Park have not yet been legislated but public education and awareness programmes are being executed by the NHD and the CZMU in relation to the importance of the protected areas and the benefits that can be derived from conservation and management.
2.2. To enhance and secure involvement of indigenous and local communities and relevant stakeholders.	Full and effective participation by 2008, of indigenous and local communities, in full respect of their rights and recognition of their responsibilities, consistent with national law and applicable international obligations, and the participation of relevant stakeholders, in the management of existing, and the establishment and management of new, protected areas	The establishment of the Community-based Coral Reef Monitoring and Management in relation to the Folkestone Marine Reserve can be described as achieving this target. The National Park and Carlisle Bay Parks have not yet been legislated but public education and awareness programmes are being executed by the NHD and the CZMU in relation to the importance of the protected areas and the benefits that can be derived from conservation and management of these areas by communities. The Graeme Hall Swamp Ecosystem is a unique series of natural features, including an extensive inland

[76] http://www.nccbarbados.gov.bb/community-based-coral-reef-monitoring-and-management

		wetland, a large beach area and an offshore reef complex. This ecosystem is designated as a Natural Heritage Conservation Area. However, a portion of the land area was owned and operated by a private developer as Nature Sanctuary and a portion by the Government of Barbados.
3.1. To provide an enabling policy, institutional and socio-economic environment for protected areas.	By 2008 review and revise policies as appropriate, including use of social and economic valuation and incentives, to provide a supportive enabling environment for more effective establishment and management of protected areas and protected areas systems.	The Draft EMA will serve as the enabling legislation for the National Park Plan which is policy document that is used as a guide for activities that can be undertaken within the National Park. The absence of this legislation limits the enforcement power of the Department. The proposed Barbados National Park and Natural Heritage Conservation Areas (NHCA) are expected to deliver socio-cultural, environmental and economic benefits to the people of Barbados[77].
3.2. To build capacity for the planning, establishment and management of protected areas .	By 2010, comprehensive capacity- building programmes and initiatives are implemented to develop knowledge and skills at individual, community and institutional levels, and raise professional standards	Work in this area is ongoing. To date the Department has conducted numerous activities in support of the department's objective to "define and protect a functionally connected natural heritage system based on an ecosystem approach" Some of this work included: • data collection, recording and mapping of Protected Areas (PA) and the Proposed National Park. • Institutional Strengthening of NHD for management of Protected Areas (PA) / National Park and NHCAs. • Internal Review of the *Physical Development Plan (PDP) (Amended 2003)* and Reports produced from EMLUP Study.

[77] Government of Barbados, Ministry of the Environment, Water Resource Management and Drainae.2009.*Economic and Social Report of the Ministry of Environment and Drainage*

		• Establishment of partnerships with landowners to allow for conservation projects; and enhancement of livelihoods. • Initiating the process of staff training in Protected Areas (PA) and National Park Management. • Development of an education and awareness plan to sensitize Barbadians about protected areas[78]
3.3. To develop, apply and transfer appropriate technologies for protected areas.	By 2010 the development, validation, and transfer of appropriate technologies and innovative approaches for the effective management of protected areas is substantially improved, taking into account decisions of the Conference of the Parties on technology transfer and cooperation.	This target has not been met.
3.4. To ensure financial sustainability of protected areas and national and regional systems of protected areas.	By 2008, sufficient financial, technical and other resources to meet the costs to effectively implement and manage national and regional systems of protected areas are secured, including both from national and international sources, particularly to support the needs of developing countries and countries with economies in	The Government of Barbados provides funding to the Natural Heritage Department to implement the programme concerned with biodiversity conservation and management in Barbados. However, the amount of funds allocated is not always adequate to undertake the work and as a result funding is sought from international funding agencies. In 2009 the NHD advanced its technical and financial assistance to the communities of the Harrison's Cave

[78] Government of Barbados, Ministry of the Environment, Water Resources and Drainage, 2009. *Economic and Social Report of the Ministry of the Environment, Water Resources and Drainage*

	transition and small island developing States.	Zone of Special Environmental Control (ZSEC) through the following initiatives which constitute a Community Participatory Programme: • *Preparation of a strategic plan* to implement deliverables of the investigation of the ZSEC, assessing the socio-economic impact on residents, and to determine whether sewering of the area and a comprehensive environmental education programme are justifications to relax some restrictions of the ZSEC. • *Digital mapping* of the ZSEC using GIS and photography and production of a comprehensive management plan to monitor and redress current pollution in the Zone. Liaising with relevant Departments of Government as management strategy. • *Building Capacity* in the communities through programmes such as: Community Conservation and Regenerative Projects; also training in Small Business Management, Community Mobilization and Volunteerism, Heritage, Tourism and the Environment, Project Conceptualisation and Project Implementation; Proposal Writing; Interpretation and Tour-guiding. • *Participatory Programmes* incorporating de Heart uh Barbados® Heritage Celebrations, UNESCO Youth PATH; extension of Primary and Secondary Schools' Participatory Programme in ZSEC and its buffer zones through sponsorships and formulation of schools Environmental Clubs and other meaningful initiatives. Sponsorship of community organizations making a

		meaningful contribution to society. • *Working Partnerships* with Departments of Government such as the Community Independence Celebrations Secretariat, Community Development Department, Ministries of Culture, Tourism, Agriculture, Health, and Education and Human ; as well as continued collaboration with youth organizations (NGOs) such as Barbados Environmental Youth Network. Continued Pilot Projects in association with UNESCO.[79] The National Park plan also makes recommendations for a National Park and Marine Park Cost Recovery Strategy. This includes recommendations for direct cost recovery through entrance fees.
3.5. To strengthen communication, education and public awareness.	By 2008 public awareness, understanding and appreciation of the importance and benefits of protected areas is significantly increased	Although the Department continues to move forward with its biodiversity programmes and activities, this work is occurring at a significantly reduced pace as a result of inadequate staffing levels. The NHD is currently examining ways to increase the staffing levels so as to assist with the implementation of the Department's mandate. However, the NHD continues to conduct environmental education and awareness programmes as within the national park.
4.1. To develop and adopt minimum standards and best	By 2008, standards, criteria, and best practices for planning, selecting, establishing, managing	The National Park Development Plan details guidelines and targets to support selection, establishment, management and operation of the

[79] Government of Barbados, Ministry of the Environment, Water Resources and Drainage, 2009. *Economic and Social Report of the Ministry of the Environment, water Resources and Drainage*

practices for national and regional protected area systems.	and governance of national and regional systems of protected areas are developed and adopted.	Barbados National Park and other Natural Heritage Conservation Areas. The guidelines related to the National Park are in the areas of agriculture, forestry and soil conservation; habitat and species conservation; cultural heritage conservation; marine conservation and community development.
4.2. To evaluate and improve the effectiveness of protected areas management.	By 2010**,** frameworks for monitoring, evaluating and reporting protected areas management effectiveness at sites, national and regional systems, and transboundary protected area levels adopted and implemented by Parties	The Departments responsible for the Management of the legislated and proposed protected areas in Barbados have their own internal methods of reporting but the extent to which this involves the monitoring, evaluating and reporting on the effectiveness is limited.
4.3. To assess and monitor protected area status and trends.	By 2010, national and regional systems are established to enable effective monitoring of protected-area coverage, status and trends at national, regional and global scales, and to assist in evaluating progress in meeting global biodiversity targets	This has not yet been achieved for the National Park nor Carlilse Bay. The Draft EMA will serve as the enabling legislation for the National Park Plan which is policy document that will be used as a guide for activities that can be undertaken within the National Park. The absence of this legislation limits the enforcement power of the Department. This has been achieved within the context of the FPMR.
4.4 To ensure that scientific knowledge contributes to the establishment and effectiveness of protected areas and protected area systems.	Scientific knowledge relevant to protected areas is further developed as a contribution to their establishment, effectiveness, and management	A significant amount of research has been done as it relates to resources within marine protected areas and this work has contributed to the effectiveness and management of the park.

APPENDIX VI: SYNOPSIS OF BIODIVERSITY'S IMPORTANCE TO BARBADOS

Table 11: Overview of the Importance of Biodiversity in Barbados

Ecosystem Type	Extent	Main Habitats	Main Species	Main Genetic Diversity	Importance to Human Well-Being	Importance for ecosystem Integrity	Importance for Other values
Terrestrial[80]	430 km sq; 43,000 ha land						
Fauna							
	Mammals The only indigenous extant mammals are 6 species of bats.						
	6 species endemic sub-species Indigenous	Wooded ravines Dense forests Fruit plantations Caves	**Bats**	*Monophyllus plethodon plethodon* *Myotio martiquensis* *Molossus molossus molossus* *Brachyphylla cavernarum* *Artibeus jamaicensis* *Noctilio*	Consumption of mosquito larvae	Overall biological control – insect control Pollinators Seed dispersal	Scientific Educational

80 A more exhaustive list can be found: J. A. Horrocks 1997. Distribution, Abundance and Issues Affecting the Status of Selected Vertebrates in Barbados. http://www.cavehill.uwi.edu/FPAS/bcs/courses/Ecology/Ecol2453/Selected%20Barbados%20vertebrates.pdf

				leporinus leporinus			
	Endemic *Believed to be extinct*[81]	No published data	**Raccoon**	*Procyon gloveralleni* Believed to be a sub species of the common raccoon *Procyon lotor*			
	Common	Dense cover of relatively tall vegetation	**Mongoose**	*Herpestes javanicus* Introduced from Jamaica Introduced 1870s	Unknown	Introduced to control rats, a pest of sugarcane May have been responsible for the extinction of the grass snake	Predation – snakes May be responsible for the reduction in numbers of other species such as turtles
	Rare	Grasslands, Cane fields	**Wild hare** (European Hare or Cape Hare)	*Lepus capensis* Introduced as hunting game from Europe	Debate over whether or not European and Cape hare are separate species	Unknown	Intrinsic environmental benefits
	Common 1980 survey – 14, 800	Prefer the forested/ wooded areas adaptable and can	**African green monkey**	*Chlorocebus aethiops subaeus*	Causes extensive crop damage	Seed dispersal	Exported for biomedical research

81 1996 IUCN classification, last sighted in 1964, mounted specimen held at the Barbados Museum (Source http://en.wikipedia.org/wiki/Barbados_raccoon)

	1994 survey – 14, 200	be found in both rural and urban areas of Barbados		Introduced around 1600s	Some diseases can be transmitted from monkeys to humans		Study of HIV/AIDS Tourism
	Birds[82] Barbados has diverse species of birds, some of which are seasonal migrants. There are 36 resident species of birds and about 16 exotics. Approximately 150 migratory bird recorded. According to the IUCN Red List (BirdLife International 2009), 0.9% of the birds in Barbados are threatened. A further 4 species are classified as Near Threatened.[83] Many of the island's resident avian species are protected under the Wild Birds Protection Act Cap 398.						
	Common (14,000 cattel egret recoded 1997)	Grasslands Mangrove swamps Wooded areas Abandoned buildings Country ponds/ Wetlands Sea cliffs Pastures	Icterids -	Carib Grackle, Shiny Cowbird Grey Kingbird, Columidae – Zenaida & Ground doves, Pigeons; Cattle egret	Important indicator as to the health of the ecosystem in general and can serve as early warning in relation to environmental hazards which can negatively impact on human health Vectors - Some disease-causing organisms such as viruses can mutate and be transferred	Agricultural systems maintenance - Pollination, seed dispersal, Control insect and other animal populations	Agriculture Eco-tourism – bird watchers, Naturalists Game hunting Pet Trade (guided by CITES)
	Rare		Caribbean Elaenia; Brown-throated Parakeet; Scaley-breasted Thrasher; Pearly-eyed Thrasher; Cayenne Night				

82 http://en.wikipedia.org/wiki/Fauna_of_Barbados – provides a summary of avifauna in Barbados; also http://www.cavehill.uwi.edu/FPAS/bcs/courses/Ecology/Ecol2453/Selected%20Barbados%20vertebrates.pdf ; http://en.wikipedia.org/wiki/List_of_birds_of_Barbados

83 Supporting Information for 4th National Reports for the Convention on Biological Diversity provided by BirdLife International

			hawk; Budgeriga r, Guinea bird		from birds to humans		
	Extinct		Trembler; White-breasted Thrasher; Lesser Antillean Flycatche r; Black Swift; Tropical Mocking Bird; Sora Rail, Barn Owl				
	Extirpated		Grassland Yellow Finch; Scaly-breasted Thrasher				
	Threatened		Yellow Warbler; Red Seal Coot; Audobon' s Shearwate r				
	Endemic		Antillean bullfinch; Florida Gallinule (endemic sub-				

			species)				
	Migratory (150 species)		Seabirds (gulls, terns) Shorebirds (plovers, sandpipers)				
	Winter Residents		Osprey; Great Blue Heron; Little Blue Heron; Purple Gallinule; American Redstart				
	Reptiles Mainly lizards, geckos, snakes, tortoises, marine turtles. There are 15 reptile species reported on Barbados, two of which are possibly extinct, including the endemic Barbados Racer (Liophis perfuscus). The Barbados Leaf-toed Gecko (Phyllodactylus pulcher) and the Barbados Threadsnake (Leptotyphlops carlae) are endemic. Another species, the Barbados Anole (Anolis extremus), was endemic to Barbados but has been introduced to other islands.						
			Snakes[84]				
	Endemic – described in 2008	Ground litter	*Leptotyphlops carlae* (Worm snake)	Thought to have been *L. bilineatus*	Unknown	Controls populations of insects and rodents, small mammals	Education Intrinsic environmental benefits
	Endemic. Endangered,	Ground litter/arboreal	*Mastigodryas bruesi*				

84 http://en.wikipedia.org/wiki/List_of_amphibians_and_reptiles_of_Barbados

	possibly extinct						
	Describes in 2008		*Liophis perfuscus* *Phyllodactylus pulcher* *Ramphotyphlops braminus (flower pot blind snake)*				
			Lizards				
	Endemic Common	Ground litter Houses Trees & bush	Barbados Anole	*Anolis extremus*	Unknown	Insect control	Education
	Only *Kentroyx Sp*. Found in Eastern Caribbean Rare	Trees & bush	Guyana Kentropyx, Guyana Tegu	*Kentropix borkiana*			
	Range not systematically studied Endemic	Trees & bush	Barbados Leaf-toed gecko	*Phyllodactyllus pulcher*			
	Rare		Bronze coloured Skink	*Mabuya mabuya*			
	Common		House Gecko	*Hemidactylus mabouia*			

	Rare		Underwood's Speckled Tegu	*Gymnopthalmus underwoodi*			
			Tortoises				
	Extinct		(Giant Tortoise)	*Geochelons Sp*			Tourism Education
		Captive Gully woodlands	Red-footed tortoise	Introduced, captive populations, few escaped in the wild	Pets	Unknown	Tourism Education
			Turtles				
	Two species of marine turtles nest in Barbados 100-120 nests (about 250 females) Critically endangered	Marine	Hawksbill Turtle	*Eretmochelys embricata*	Positive impact on the health of coral reefs and seagrass beds which supply fish and other marine species for human consumption	Maintain health of coral reefs and seagrass beds	Tourism Education
	About 10 females nests Endangered	Marine	Leatherback Turtle	*Dermochelys coriacea*			
	10 main nearshore nesting sites Endangered	Marine	Green turtle	*Chelonia mydas*			
	Amphibians Two species of amphibians on Barbados, one of which was introduced.						
	Common		Cane	*Bufo marinus*	Nutrient	Pest control	Tourism

			Toad	Introduced	cycling Insect control and reduction in insect borne diseases Toxins used in medicine – bio-medicines Serve as indicators of overall health of the environment	in sugar cane Insect control source of food for other animals	Education Research and Development Medicinal uses in other countries
		Common	Whistling frog	*Eleutherodactylus johnstonei* Professor S. Blair Hedges in 2008 compared the DNA of the frog *Eleutherodactylus johnstonei* from several localities in Barbados with samples from other islands. It is genetically identical to those populations on other islands which indicate that this species was introduced		Insect control	Education

				to Barbados (supported by historical accounts).			
	Insects & Allied Arthropods There is an estimated 1,320 species of insects in Barbados. Limited quantitative data is available with respect to the distribution and numbers						
	Limited data available	Limited data available	Limited data available	Limited data available	Source of food Pollinators Positive and negative impact on food security Spread diseases that can affect humans and animals	Of critical importance to the food web Act as herbivores, predators, decomposers, parasitoids and pollinators Indicators of ecosystem integrity Ecosystem stabilization Provide habitat for other organisms Pest and weed control	Tourism Education biological control – agriculture Culture & folklore

		Vegetation Ground cover	Beetles[85]:	*Chrysobothris antillarum* Fisher *Selenophorus barbadebsis* Ball and Shpeley *Lagocheirus unicolor* Fisher *Plectromerus louisantoini* Dalens and Touroult *Acritus strigipennis* Bickhardt *Phyllophaga smithi* (Arrow) *Oligota barbadorum* Frank *Clavilispinus mariannae* Irmler			
Flora	Barbados has about 700 species of flowering plants with 3 species being endemic and 23 species require protection (8 are rare and endangered and 15 species are known to exist at only one site. Forest tree cover is estimated at 2 – 4.6% of land area (~ 800 - 2000 ha) and can be found mainly in gullies, coastal woodlands, undercliff woods and other planted wooded areas.						
Terrestrial -		Beaches, Sand Dunes, Sandy Bushlands	Xerophytic vegetation	*Philoxerus vermicularis, Ipoema pescaprae, Coccoloba*	Source of food Source of medicine & herbs	Provide habitat for other organisms	Traditional medicine Education

85 Stewart, P. 2009. The Beetles of Barbados, West Indies (Insecta Coleoptera): Diversity, Distribution and Faunal Structure. Centre for Systematic Entomology, Gainesville, Florida. Insecta Mundi. http://digitalcommons.uni.edu/insectamundi/596

				uvifera	Purification of water systems	Indicators of ecosystem integrity Pollinators Prevention of coastal erosion	Tourism Recreation Bio-medicine Carbon storage Green house gas regulation Prevention of soil erosion Nutrient recycling Genetic diversity
		sea cliffs and sea rocks	Halophytes and Grasses	*Paspalum distichum, Sporobolus virginicus, Dactyloctenium aegypticum, Eleusine indica, Croton balsamifer, Jatropha gossypifolia, Lantana camara*			
		Inland cliffs and Rocky lands		*Tabebuia pallida, Lantana involvucrata, Peperomia magnoliifolia,*			

				Bryophyllum pinnatum			
Marine		Coastal wetlands		*Rhizophora mangle, Laguncularia racemosa, Nelumbo nucifera, Eleocharis geniculata, Abilgaardia mosotachya, Fimbristylis ferruginea, Sporobolus virginicus, Philoxerus vermicularis, Conocarpus erectus*			
	Gullies account for 5% of land area with 35% of native plant diversity 37 species of ferns and fern allies. 22 species of mosses, four species of leafy liverwort and one hornwort	Gullies	Ferns:	*Pteris vittata, Adiantum tenerum, Neurodium lanceolatum, Polypodium Latum*			
			Shrubs:	*Tecoma stans, Psidium guajava,*			

				Clerodendrum aculeatum. Solanum recemosum var. igneum, Pisonia aculeata, Coccoloba venosa, Miconia laevigata, M. cornifolia, Piper filatatum			
			Climbers:	*Turbina corymbosa, Merremia umbellata, M. dissecta, M. aegyptica, Jacquemontia pentantha, Clitorea ternatea, Arbus precatorius, Passiflora foetida*			
	2% land cover (~ 800 ha)	gullies, coastal woodlands, undercliff woods and other planted wooded areas.	Trees:	*Ceiba pentandra, Maclura tinctoria, Hura crepitans, Citharexylum spinosum, Sapium hippimane, Cecropia Shreberiana, Inga laurina,*			

				Spondias mombin, Bursera simaruba, Aiphanes minima, Roystonea oleracea			
	2% land area (~ 800 ha)	Forests					
Marine and Freshwater (fauna)	Barbados' marine and freshwater ecosystems consist of wetlands and water catchments, rocky intertidal, tidepools, seagrass beds, coral reefs, and the deep-water benthic communities. There are about 990 genera approximately 1548 species of organisms living in these ecosystems.[86] Of this number, there are an estimated 1016 fish species none of which are endemic and 14 are classified as threatened.						
Freshwater							
		Wetland					
	32 ha	Graeme Hall Swamp – largest body of inland water; about 5 other recoded mangroves on the island	Migratory and resident birds (see information recorded on birds)		Food source Bio-medicine	Home to endemic, threatened and endangered species Food security support to resident and migratory birds Maintenance	Education Tourism Recreation Fisheries & Aquaculture Conservation

86 Baer, A. 2001. Aquatic biodiversity in the National Biodiversity Strategy and Action Plans of Signatories to the Convention on Biological Diversity. Part 1: Summaries for Countries with Significant Aquatic Diversity Concerns. World Fisheries Trust. Victoria BC, Canada.

						of ecosystem balance Breeding ground for near-shore species	
			Tree muscles, Sponges, Oysters, Barnacles, Tilapia, Fresh water fish, Shrimp, Mullet, Snapper, Grunts, Tarpon, Snook				
	Several locations: Bawdens, long pond, green pond, Hillaby, Bathesheba, Consett, Codrington, Three houses, Culpepper	Water Catchments	Shrimp				
Marine							
Rocky Inter-tidal		Rock cliffs, Low lying platforms, tidal pools, pebble	Algae, Fish, Crustacea				

		beaches	ns, Cnidarians, Mollusks, Annelids, Echinoderms				
Seagrass Bed			Turtle grass, manatee grass, shoal grass Sea urchin, green turtle, fish (mullet, grunt, razor fish, wrasse)				
Coral Reefs	West, south coast	Patch reefs, Bank reefs, Fringing reefs, Benthic communities	Mono-species hard coral, multi-species hard and soft coral, Fish, turtles, Coelenterates, Mollusks, Echinoder				

			ms				
Fisheries Resources[87]	48,800 km^2 approx. Shelf area 320 km^2 9 main fisheries	Marine	Shallow shelf reef fishes	Hinds (Serranidae) Parrotfishes (Scariade) Grunts (Haemulidea) Surgeonfishes (Acanthuridae) Triggerfishes (Balostidae)	Food source Animal feed Source of biomedical and bio-cosmetic compounds Use as fishing bait Food security	Ecological functions Indicator of health of the ecosystem	Educational Cultural Tourism Agriculture Recreation
			Deep Slope & Bank Reef Fishes	Snappers:Lutjanidae – Queen Snapper (*Etelis oculatus*); Silk Snapper (*Lutjanus vivanus*); Vermillion Snapper (*Rhomboplites aurorubens*)			
			Coastal Pelagics	Jacks (Carangidae) Herrings (Clupeidae)			

87 Sources: FAO Fishery Country Profile – Barbados www.fao.org.fi/oldsite/FCP/en/BRB/profile.htm
Project Global – Global Bycatch Assesment of Long-lived Species, Country profile. Barbados (Draft)
Mohammed E., Parker C., and Willoughby S. 2003. Fisheries Centre Research Report. Vol. 11(6) p.45-66.
McConney P. Multi-Objective Management of In-shore Fisheries in Barbados; A Biodiversity Perspective.
Barbados National Biodiversity Strategy and Action Plan.

				Anchovies (Engraulidae) Ballyhoo (Hemiramphus spp) Robins or Scads (Decapterus spp) Barracuda (Sphynaena spp) Garfish & small tuna			
			Large Pelagics	Tunas (Scombroidae); Whaoo (*Acanthocybium solandri*); billfishes (Istiophoridae); Dolphin (*Coryphaena hippurus*); Swordfish (*Xiphias gladius*); Mackerels (Scombermorous spp)			
	90% catch		Flying fish (four winged)	*Hirundichthys affinis*			
			Sea urchin - White sea urchin	*Tripneustes ventricosus*			Education
			Lobster		Food source		
			Conch –	*Strombus gigas*	Food source		

			queen conch				
	Year round appearances		Bottle nose dolphin				
	Seen March – May		Humpback whales				
	Moratorium in turtle capture since 1998		Sea Turtle				
Agricultural Ecosystems	50% total land area	mono-specific plantations Small land holdings Backyard gardens Livestock farms	Sugar cane, small-scale vegetable, root crop and fruit tree cultivations, and pastures with livestock.	**Crops:** sugarcane, cotton, root crops, corn, onions, other vegetables, cassava, yam, pineapple, pigeon peas	Food source Animal feed	Seed dispersal Habitat for other organisms Soil organisms Germplasm conservation Extensive use of imported commercial varieties results in limited use of indigenous varieties	Agro-tourism Source of genes for agricultural production Food security Bio-medicines Education
	200 ha			**Fruit Trees**: Citrus, mango avocado, Bajan cherry, papaya, bananas,	Food source	Food source	Food security Medicinal purposes

				plantain, figs			
	25 ha			**Cut Flowers/ Foliage:** e.g. anthurium, ginger lilies, tuberoses, ferns	Food source	Food source	Intrinsic value
			Livestock : chickens, turkeys, cattle, sheep, goats, and pigs	**Chicken:** Layers – rhode island red, White leghorn Broilers – commercial hybrids	Food source	Mainly commercial livestock with limited use of traditional breeds	
				Sheep: Barbados Blackbelly, Wiltshire, hybrids	Food source		Of value in hadicr
				Cattle: Dairy – Holstein. Jersey, Creole Beef – Holestein, Red poll, hybrids			
				Goats: Creole, Sanaan, British Alpine, Toggenberg, Anglo-nubian, French Alpine			
				Pigs: Large white, landrace, Duroc			