THE GOVERNMENT OF BARBADOS

Ministry of Environment, Energy & Natural Resources

First National Report to the Conference of Parties
to the
Convention on Biological Diversity

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SIMMONS & ASSOCIATES, Inc.

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ACRONYMS

ARVTU	Agronomy Research and Variety Testing Unit
BAMC	Barbados Agricultural Marketing Company Ltd.
BMHS	Barbados Museum and Historical Society
BWA	Barbados Water Authority
CARDI	Caribbean Agricultural Research and Development Institute
CBD	Convention on Biological Diversity
CBO	Community-based Organisation
CBS	West Indies Central Sugar Cane Breeding Station
CERMES	Centre for Resource Management and Environmental Studies
CITES	Convention on International Trade in Endangered Species of Flora and Fauna
COP	Conference of Parties
CTP	Chief Town Planner
CSEGRIN	Caribbean Seed and Germplasm Resources Information Network
CZMP	Coastal Zone Management Plan
CZMU	Coastal Zone Management Unit
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMLUP	Environmental Management and Land Use Planning for Sustainable Development Project
ESPU	Environmental Special Projects Unit
FAO	Food and Agriculture Organisation of the United Nations
FMP	Fisheries Management Plan
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIS	Geographical Information System
GOB	Government of Barbados
HIV	Human Immunodeficiency Virus
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICMP	Integrated Coastal Management Plan
IUCN	International Union for the Conservation of Nature and Natural Resources
MAPEA	Marine Areas Preservation and Enhancement Act
MARD	Ministry of Agriculture and Rural Development
MAREMP	Marine Resources and Environmental Management Programme
MEE	Ministry of Environment, Energy and Natural Resources
NBSAP	National Biodiversity Strategy and Action Plan
NCC	National Conservation Commission
NCF	National Cultural Foundation
NGO	Non-government Organisation
NPDP	National Physical Development Plan
NRMP	Natural Resources Management Programme
QEH	Queen Elizabeth Hospital
SIDS	Small Island Developing States
SPAW	Protocol (to the 1983 Cartagena Convention) Concerning Specially Protected Areas and Wildlife in the Wider Caribbean
TCPD	Town and Country Planning Department
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Nations Convention on Law of the Sea
UNEP	United Nations Environment Programme
UWI	University of the West Indies
WBPA	Wild Birds Protection Act

Barbados' First National Report to the Conference of Parties to the Convention on Biological Diversity

ES 1.0 EXECUTIVE SUMMARY

ES 1.1 Introduction

The universal effort to conserve biodiversity is enshrined in the Convention on Biological Diversity (CBD), which was initially signed by 154 nations at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in June, 1992. Since UNCED, additional nations have also signed the Convention. The Government of Barbados (GOB) ratified the CBD on December 10, 1993. This means that the country is bound by provisions of the Convention and has a responsibility for ensuring that the provisions of that Convention are met, in accordance with the particular conditions within the country and with the available financial, technical and other resources.

In Article 6 of the CBD, "*General Measures for Conservation and Sustainable Use*" governments are called upon to formulate a National Biodiversity Strategy and Action Plan (NBSAP) for the protection and sustainable use of biodiversity within the framework of the CBD. Pursuant to Article 6, Article 26 requires that:

> Each Contracting Party, shall at intervals to be determined, present to the Conference of Parties (COP), reports on measures which it has taken for the implementation of the provisions of this Convention and their effectiveness in meeting the objectives of the Convention.

The Ministry of Environment, Energy and Natural Resources (MEE) is responsible for the implementation of the obligations of the CBD. The Ministry also chairs a multi-sectoral Steering Committee, which oversees this process and currently has in place a work programme for the conservation and sustainable use of biodiversity in Barbados. The objectives of the Ministry's work programme are to:

- develop a more informed basis for decision making and policy formulation on the management of biodiversity in Barbados;
- develop a more comprehensive information data base for the management and utilisation of biodiversity;
- enhance the regulation of the domestic and international trade in endangered species and specimens of flora and fauna; and
- promote the full appreciation of biodiversity as a national resource.

Some the proposed outputs of the MEE Biodiversity Work Programme includes:

- a National Strategy & Action Plan document for biodiversity;
- a database for fauna and flora;
- a management plan for selected species
- a policy on habitat management relating to the Graeme Hall Swamp and other natural habitat areas, and
- draft legislation to give domestic effect to international conventions on biodiversity.

Among the specific activities being undertaken in fulfilling the above objectives are the preparation of a National Biodiversity Strategy and Action Plan and the preparation of this National Report to the Conference of Parties (COP) to the Convention on Biological Diversity. The NBSAP is intended to define the current status of biodiversity, the threats leading to its degradation and the strategies and priority actions which are required to ensure its conservation and sustainable use within the framework of the socio-economic development of the country. In keeping with the requirements of Article 26 of the Convention, this National Report, has been prepared to demonstrate what Barbados is doing in fulfilment of its commitment to the Convention of Biodiversity as well as outlining the policies, and programmes being implemented or proposed for implementation. The undertaking has been funded by the United Nations Environment Programme (UNEP) through a Global Environment Facility (GEF) project.

ES 1.2 The Importance of Biodiversity

Biodiversity is the totality and variety of genes, species and ecosystems occurring in a region. The biodiversity in any such region is the result of hundreds of millions of years of evolutionary history. Biodiversity has also been shaped over time by human intervention through the domestication and breeding of local varieties of crops and livestock. The various components of biodiversity have enormous importance to all aspects of human life especially food, medicines, industrial and agricultural products, and in addition, provide the basis for recreation and tourism. Over time, the greatest value of biodiversity may be found in the opportunities that it provides to humanity for adapting to local and global changes. Biodiversity conservation is concerned not only with the protection of wild species but also with the safeguarding of the genetic diversity of cultivated and domesticated species on which we depend.

Being a relatively small country with a history of over three hundred years of extensive development, the island of Barbados has a limited stock of biological diversity and its existing natural habitats are constantly under threat from the encroachment of human development and other activities due to easy access to most remote areas. Development activities, including tourism developments, extensive residential and commercial development, rural subdivisions, and intensive mono-culture agriculture, are among the contemporary issues which have all contributed to the decline of the island's biodiversity. These issues, coupled with the island's relatively scarce land

resource endowment create an even greater need for specific strategies to conserve biodiversity in Barbados.

ES 1.3 Threats to Biodiversity

The major threats to biological diversity in Barbados are habitat loss and fragmentation. Habitat disturbance does not only precipitate loss of species, it also represents a loss of biodiversity in its own right. During colonial times, substantial vegetation was cleared for agricultural purposes, building materials and firewood. More recently, vegetation loss has resulted primarily from land clearing to facilitate residential development, the largely *ad hoc* urbanisation process and the tourism sector for developments.

The construction of hotels and marinas, particularly along the west and south coasts, has reportedly caused the destruction of native plant communities. Several proposals for the creation of golf courses were submitted by investors to the government for approval. The areas most often targeted for these facilities are likely to be marginal abandoned agricultural lands, which have been undergoing the processes of regeneration with natural vegetation, thus land use conflicts have been arising in recent years between development and conservation issues.

There are indications, also, that the marine and possibly the freshwater ecosystems are under stress. Among the marine species, the hawksbill turtle, *Eretmochelys imbricata* (IUCN, 1996) is critically endangered. The nearshore benthic marine communities are also being degraded primarily by deteriorating water quality, arising mainly from increased sedimentation, eutrophication and sewage pathogens, localised increases in temperature, decreases in salinity and perhaps increases in toxins, over fishing, physical damage and use of destructive fishing methods, such as dynamite.

Poor monitoring or regulation of the use and disposal of agrochemicals has been said to have adversely affected marine aquatic species health as well as the health of terrestrial animals which use agricultural fields for foraging. Further research has been recommended in order to adequately assess the extent of this problem.

The unregulated introduction of exotic species in Barbados has been recognized as presenting a severe threat to the local flora of the island. Relatively recent introductions on the island such as the Mongoose, and the Green Monkey, as well as the recent arrival of the Cattle Egret has been said to have adversely affected various indigenous species, habitats and in some cases agricultural produce. Legislation is currently being drafted by the GOB in order to address the introduction of exotic species into Barbados. Increased awareness among the judiciary, law enforcement officers, and immigration officers, and other relevant parties with regard to the importance of the enforcement of penalties for offences related to illegal importation of exotic species is required. The control of the

transmission of exotic pests and diseases such as the Tropical Bont Tick, among others, also presents a major challenges for the local agricultural industry.

Other activities, which impact upon biodiversity, include resource extraction e.g such as limestone and sand mining. These activities are generally regarded as national economic necessities, and as such, need to be carefully planned and strictly controlled to ensure minimisation of the potential negative impacts, such as loss of species diversity, and degradation of habitats.

In addition, the lack of a clear policy on biodiversity, together with the absence of clear legislation or an adequate institutional framework all contributed to the void which existed for the sustainable management and conservation of biodiversity. In recognition of this void, the MEE has taken steps to provide a coordinating mechanisms for developing clear policies and initiatives aimed at boidiversity conservation. These initiatives, include the preparation of a National Biodiversity Strategy and Action Plan, as well as the preparation of specific sectoral plans aimed at developing the research capacity.

ES 1.4 Goals and Objectives of NBSAP

The goals and objectives of the Strategy and Action Plan are intended to establish the framework within which biodiversity resources can be conserved and sustainably utilised and range from measures to develop and implement a national biodiversity policy, to undertaking research in respect of specific species. The specific objectives guiding the development of the NBSAP were as follows:

- Identification of the current state of knowledge about biodiversity in Barbados;
- identification of important gaps in the knowledge base and the assessment of further needs and associated costs;
- identification of current pressures on biodiversity in Barbados and future trends;
- assessment of the present and future value to Barbadians of the country's biodiversity;
- assessment of the costs and benefits of conserving biodiversity in Barbados;
- identification of conservation priorities and initiatives for conserving biodiversity;
- identification of appropriate implementation methodologies

The Barbados NBSAP comprises a number of goals, objectives, strategies and actions which seek to provide the enabling platform for the development and application of biodiversity conservation principles across the entire range of economic, social and cultural sectors as identified in the Country Study Technical Reports (Simmons & Associates, 1998).

These overall priorities for conservation action as articulated in the NBSAP study include:

- *The Conservation and Sustainable Utilisation of Biodiversity*
- *Improved Public Awareness and Education on Biodiversity Issues*
- *Fair and Equitable Sharing of Benefits Arising out of the Use of Biodiversity*
- *Improved Biodiversity Research and Data Storage*
- *an Ongoing Programme of Monitoring of Species Conservation*
- *Improved Access to Adequate Financing for the Management and Conservation of Barbados' Biodiversity*
- *and the Reduction of Biodiversity Loss Through Overexploitation Caused by Poverty.*

ES1.5 The Barbados Biodiversity Strategy & Action Plan Framework: Strategic Recommendations

The national vision for the conservation and sustainable use of biodiversity in Barbados is enshrined in a set of principles which guide the thinking and provide the basis on which many of the programmes will be developed, including the rationale for further research and the establishment of monitoring parameters.

Coming out of these principles a set of specific goals have been outlined which are aimed at addressing the threats to biodiversity. These are:

- **Sustainable Development**
- **Environmental Preservation**
- **Responsible Economic Decision-Making**
- **Protection of National Biological Heritage**

Strategic Recommendations

The NBSAP Country Study and the Public Consultation process identified a number of areas, which would greatly enhance the GOB's capacity to undertake effective conservation and management of the island's biodiversity. In developing a comprehensive response to the conservation of biodiversity, the following recommendations were made:

Institutional Strengthening & Enforcement:

There is an inherent lack of the regulation of development and other human activities which have the potential to adversely impact on biodiversity, as well as, inadequate enforcement of existing

regulations which provide for the protection of biological resources in Barbados. This prevailing situation is largely due to insufficient resources and institutional support available for monitoring and enforcement activities.

The lack of a legally binding National Physical Development Plan (NPDP) was found by the EMLUP study (1998) to reduce the capacity of the GOB to achieve effective habitat and species protection. This deficiency also curtails the GOB's ability to address other wider environmental degradation concerns through the planning process. As a result of these findings, two recommendations were made with respect to enhancing the legal status of the development plan:

- establishing the (NPDP) as Development Control Regulations, or
- implementing the (NPDP) as a first Screen for Development Applications.

The EMLUP Study made a number of recommendations aimed at improving the level of transparency and public participation in the planning process. Among these was the formal revision of the current Town and Country Planning Advisory Committee was recommended in order for it to effectively act in an advisory capacity to the Chief Town Planner who would in turn advise the Minister. It was proposed that this committee would comprise of technical experts from various agencies and other public and private sector organizations with appropriate expertise with regard to biodiversity and habitat conservation, among other wider environmental management concerns.

The EMLUP study also recommended the appointment of an environmental legal officer within the MEE. The rational for maintaining in-house legal services in the Environmental Unit would be its enhanced capacity to supplement the limited services currently provided by the Attorney General and the DPP office, thereby clearing up the backlog of environmental legislation, and so enabling the ministry to effectively enforce environmental standards imposed by legislation.

The in-house legal services would, among other things:

- Consult with environmental specialists to identify measures necessary to regularize their operations and make them more effective;
- Assist the Attorney Generals Office in preparing legislation on identified environmental issues;
- Prepare and process draft legislation for submission to parliament;
- advise other environmental enforcement agencies as required;
- assist in enforcement prosecutions on environmental matters as required. (EMLUP, 1998)

Other benefits which could be realized from this in-house legal capacity would include, the avoidance of inordinate delays in securing legal responses and opinions on biodiversity protection

issues, as well as assistance in assuring that Barbados ratifies, and adheres to, or complies with obligations contained in international conventions of which Barbados is a signatory.

Legal Strengthening

The following recommendations have been identified by the NBSAP Country Study Reports and Public Consultation process as high priority areas, in terms of enhancing the legal capacity of the GOB with respect to achieving functional biodiversity management and conservation:

- Legislation governing wildlife requires complete revamping in order to give effect to Barbados' acceptance of the CITES convention.
- Substantially new legislation is required for general regulation of the release of pollutants into the environment.
- EIA procedures need clear legislative authority.
- Planning legislation should be modified to attempt to ensure greater transparency and conformity with the Physical Development Plan.
- Legislation that addresses National Parks is required.
- Forestry legislation is required.
- Enhancement of the capacity to effectively prosecute violators of existing regulations put in place to ensure the protection of biodiversity.

Other Recommendations:

- Expansion of the Education and Information Unit of the MEE, with the addition of library functions, in order to effectively document and disseminate biodiversity resource information that is currently not readily accessible to all relevant organizations and agencies.
- Implementation of on-going biodiversity research, and the collation and maintenance of a comprehensive GIS database into a central repository.

- Definition of clear mandates for the relevant institutions with respect to the conservation of biodiversity, and a logical appropriation of suitably trained human resources among these institutions.

- Improvement of communication between the various institutions involved on biodiversity conservation issues and activities.

- Dissemination of biodiversity related information by relevant government agencies to increase the level of awareness of the general public of biodiversity conservation, and also to strengthen the political will of the GOB to protect biodiversity.

The conservation of biodiversity in Barbados relies heavily on the effectiveness of the GOB to streamline the operations of the various Ministries and agencies which are involved in environmental management. The formulation and delegation of clear biodiversity protection mandates among these institutions, enhanced levels of communication and documentation of biodiversity related information, and optimal utilization of resources are essential if they are to effectively carry out their functions. With the implementation of these initiatives the GOB can vastly improve upon its goals of sustainable environmental management and biodiversity conservation.

ES1.6 National Biodiversity Conservation Programmes & Initiatives

The NBSAP was envisaged to complement other plans relevant to national sustainable development planning, which have already been prepared and implemented or which are in the process of being prepared. They include the following:

- The ***Physical Development Plan (PDP)***, revised in 1998, as part of the Environmental Management and Land Use Planning for Sustainable Development Project (EMLUP).

- The ***Environmental Management and Natural Resources Management Plan (EMLUP, 1998)***, which is accompanied by area-specific plans, namely: ***The National Park Plan (EMLUP, 1998)***.

- The ***Fisheries Management Plan (FMP)*** Fisheries Division MARD, 1997.

- The ***Coastal Zone Management Plan (CZMP)*** Halcrow Group ltd. 1998.

These initiatives will complement other ongoing programmes currently being implemented by MEE. These comprise the ***Sustainable Development Programme*** with the main objective being to inform all persons in Barbados about the principles of sustainable development with the view towards

encouraging them to adopt habits and attitudes in harmony with these principles; the ***Beautify Barbados 2000 Project*** which is concerned with the overall beautification of Barbados, as well as to increase the vegetative cover, in order to mitigate against the adverse effects desertification; and, the ***Gully Rehabilitation Programme*** aimed at developing a strategic Environmental Management Framework and Programme for the rehabilitation of gully ecosystems throughout the island.

ES1.7 Monitoring & Evaluation

The MEE is the principal executing agency responsible for coordinating and monitoring the overall implementation of the NBSAP project and the biodiversity programme. An effective monitoring system, to provide detailed information about the environment and the results of policies and actions, should have the following indicators:

- status and trends of Barbados' use of terrestrial, aquatic coastal, and marine resources, habitats, species, populations, biodiversity services, and threats to biodiversity;
- shifts in selected social, political, and economic factors;
- shifts in human, institutional, facility, funding capacity;
- changes in policy and legal framework for natural resources;
- changes in the use of biological resources and their sustainability;
- trends in the monetary and non-monetary values of biodiversity and current expenditures and investments; and
- impacts of implementing the activities and policies of biodiversity plan(s).

Monitoring, supervision and general technical assistance is carried out by other relevant ministries charged with biodiversity management/conservation responsibilities, and consultants contracted to facilitate aspects of the NBSAP"s implementation.

On a daily basis, the provisions of the CBD are also considered by the Town and Country Planning Department (TCPD) during the review of applications for proposed developments. TCPD consults with the MEE which provides guidance on issues relevant to the protection and management of biodiversity.

ES1.8 Conclusion

Current initiatives being implemented, together with the plans for implementation of the activities outlined in the NBSAP provide a suitable framework 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. A NBSAP which provides for the integration of biodiversity management and conservation into these sector plans would serve to minimise overlap and increase efficiency of use of human, financial and equipment resources.

The sheer magnitude and pervasive range of the activities proposed, requires the involvement of several ministries, agencies and individuals spanning both governmental and non-governmental institutions as well as the application of multidisciplinary approaches which are sometimes non-existent or insufficiently developed. This shortcoming will present major challenges for the *National Coordination Body (NCB)* which was set up under MEE for the expressed purpose of managing the implementation of biodiversity conservation initiatives. "The NCB acts as an advisory body and has the mandate to provide potential solutions to the problems of land degradation in the Scotland District first and foremost and to articulate and facilitate concrete actions utilising low technology and strong community based solutions" (MEE, 2000)

Costs for implementing the recommended actions coming out of the NBSAP study are also expected to present added challenges, particularly when the exigencies of other development parameters are considered. New tools and instruments for valuing the contribution of biodiversity will be sought and achieved. Notwithstanding these initiatives, there must be an improvement in inter-agency collaboration and coordination of environmental and natural resources planning and management activities.

1. INTRODUCTION

1.1. Background

Barbados, the most easterly of the islands of the Caribbean, lies south of St Lucia, east of St Vincent, and north of Trinidad. The island is 34 kilometres long and 23 kilometres wide, giving it a total land area of approximately 432 square kilometres (166 square miles) and an Exclusive Economic Zone (EEZ) of 167,000 square kilometres.

Barbados' climate may be described as mild subtropical. There is a dry season from December to May and a wet season from June to November, when season cooling trade winds blow steadily form the north-east. The wet season is humid and hot, but the climate is generally pleasant, as a result of sea-breezes. The island is on the southern edge of the West Indian hurricane zone, it has not been affected by any major hurricane conditions since Hurricane Allen in 1980.

Barbados is a comparatively flat island, rising in a series of terraced tablelands to Mount Hillaby at 336 m (1,104 ft). The north-east (Scotland District) is broken, eroded and rocky. The rest of the island consists of coral limestone crossed with deep river-bed gullies, which fill with water during heavy rain. There are no permanent rivers in Barbados. On the East coast of the island, much of the shoreline is rocky and is pounded by a strong surf. On the West and South coasts, natural coral reefs surround turquoise seas and beaches of white sand, making these coasts highly valuable for tourism related development.

Barbados is divided into two distinct geologic regions. On the leeward side, there is the coral limestone area composed of a series of gently sloping, step-like terraces which covers the major part of the island. To the windward side, there are the steep, broken slopes of the sedimentary Scotland District which accounts for one-seventh of the island. The Scotland District demonstrates a rugged badland relief and reaches a maximum altitude of 340 m at Mount Hillaby. It forms an uplifted Tertiary inner core to the island which contrasts greatly with the surrounding, gently sloping, younger limestone terraces. The soft Tertiary rocks are made up of relatively low permeability sandstones, with shales and marl. Because of the low permeability, the steep gradients and heavy rainfall, the rocks are deeply gullied by temporary surface streams. Since there is little absorption into the ground, the bulk of the precipitation runs off. In the limestone area, however, the precipitation mainly infiltrates underground through gullies, cracks, fissures and solution features such as swallow-holes, and collects in large underground reservoirs which provide Barbados with its excellent water resources. (Barker, L. H., and Poole, E. G, 1982)

The population of Barbados in 1998 was 266,800, comprising 48.1 percent males and 51.9 percent females. Life expectancies for males and females in Barbados are 72.9 and 77.4 years, respectively. In the 1990s, there was a change in the demographic profile of the population, with the proportion of elderly persons in the population increasing. Currently, approximately 11.8 percent of the

population is over the age of 65 years. This increase may be attributed, in part, to the return of persons who emigrated to the United Kingdom, the United States and Canada between the 1950s and 1970s. The large net emigration to the United States, Canada and the United Kingdom during the 1950s, 1960s and 1970s, coupled with a very successful family planning programme, resulted in a low national average population growth rate. In fact, the average rate of growth during the 1970s, 1980s, and 1990s was less than one (1) percent, and that trend is expected to continue up to the year 2020.

Education, particularly higher education, is believed to be the main vehicle of social mobility in Barbados. The enrollment ratio in primary and secondary education is 100 per cent. Tertiary education is not mandatory, but is heavily subsidized by the government. Barbados boasts one of the highest levels of educational attainment among the Caribbean territories. The literacy rate in Barbados, which is estimated at 95%, is also believed to be one of the highest in the Caribbean.

Barbados has an open economy with a very narrow range of exports, a heavy dependence on imported goods and a fragile natural resource base. Although there has been an increase in the size of the offshore sector, the expansion of the tourism sector has been the primary engine of economic growth in Barbados during the 1990s. This trend is expected to continue well into the 21st Century.

1.2 The Importance of Biodiversity

Biodiversity is the totality and variety of genes, species and ecosystems occurring in a region. The biodiversity in any such region is the result of hundreds of millions of years of evolutionary history. Biodiversity has also been shaped over time by human intervention through the domestication and breeding of local varieties of crops and livestock. The various components of biodiversity have enormous importance to all aspects of human life especially food, medicines, industrial and agricultural products, and in addition provide the basis for recreation and tourism. Over time, the greatest value of biodiversity may be found in the opportunities that it provides to humanity for adapting to local and global changes.

Barbados has a well developed physical and social infrastructure including, transportation networks. The island also has one of the highest population densities in the world. These factors have, over time, led to rapid development throughout the country, and resulted in the existence of very few areas that can be considered as being truly remote. Consequently, the island's biological diversity is relatively limited and the existing natural habitats are constantly under threat from the encroachment of human activities.

The above mentioned anthropogenic pressures on land use, and by extension the biodiversity assets of Barbados, have been inadequately addressed in the past. Development activities, including tourism developments, scattered residential and commercial developments, rural subdivisions, and

intensive mono-culture agriculture, are among the contemporary issues with the potential to impact negatively on the islands' biodiversity. These issues, coupled with the island's relatively scarce land resource endowment create an even greater need for specific strategies to conserve biodiversity in Barbados.

Biodiversity conservation is concerned not only with the protection of wild species but also with the safeguarding of the genetic diversity of cultivated and domesticated species on which we depend. The negative impacts on the natural environment, including biodiversity, from development activities have far-reaching social and economic implications. Thus, Barbados requires a very strong policy on conservation that emphasises the protection of remaining natural resources, habitats and species.

1.3 Barbados' Commitment to Fulfilling the Provisions of the Convention on Biological Diversity

The universal effort to conserve biodiversity is enshrined in the Convention on Biological Diversity (CBD), which was initially signed by 154 nations at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in June, 1992. Since UNCED, additional nations have also signed the Convention. Ratification of the CBD commits Governments to correcting the imbalance between who benefits from biodiversity protection and who pays, i.e to finding equitable ways to share biodiversity's monetary and non-monetary values; to spur technological cooperation; and to establish mechanisms to finance investments that maintain the diversity of life on Earth.

The Government of Barbados (GOB) ratified the CBD on December 10, 1993 and is, therefore, responsible for ensuring that the provisions of that Convention are met in accordance with the particular conditions within the country and with the available financial, technical and other resources.

The Ministry of Environment, Energy and Natural Resources (MEE) is responsible for the implementation of the obligations of the CBD. The Ministry also chairs a multi-sectoral Steering Committee which oversees this process. The MEE currently has in place a work programme for the conservation and sustainable use of biodiversity in Barbados. The objectives of the Ministry's work programme are to:

- develop a more informed basis for decision making and policy formulation on the management of biodiversity in Barbados;
- develop a more comprehensive information data base for the management and utilisation of biodiversity;

- enhance the regulation of the domestic and international trade in endangered species and specimens of flora and fauna; and

- promote the full appreciation of biodiversity as a national resource.

One of the major initiatives being undertaken in fulfillment of the objectives of CDB is the preparation of the National Biodiversity Strategy and Action Plan (NBSAP) for Barbados. The NBSAP will serve as a basis for guiding the future activities of the biodiversity programme of the MEE; and development of policies, programmes and projects for the management and sustainable use of the island's biodiversity. This undertaking has been funded by the United Nations Environment Programme (UNEP) through a Global Environment Facility (GEF) project.

1.4 National Vision for Conservation and Sustainable Use of Biodiversity

The national vision for conservation and sustainable use of biodiversity in Barbados is enshrined in a set of principles which guide the thinking and provide the basis on which many of the programmes will be developed, including the rationale for further research and the establishment of monitoring parameters. These principles are as follows:

1. Biodiversity is a national heritage which must be sustainably managed and used for present development needs, but also conserved for future generations of Barbadians to allow them to reach their development goals.

2. All Barbadians depend on biodiversity for their social and economic well-being, and, therefore, have a responsibility to contribute to the conservation and sustainable use of biological resources.

3. Barbadians of all walks of life must become aware of the importance of biodiversity and should, as far as possible, be afforded the opportunity to participate in decision-making that affects the use of biodiversity.

4. The benefits from sustainable management of biodiversity will accrue, directly or indirectly, to all sectors of Barbadian society.

5. It is the responsibility of the Government of Barbados to formulate and implement the policy framework for sustainable management and use of biodiversity in close cooperation with scientists, the business community and the general public.

6. The interdependency of nations, particularly of Caribbean States, in the use of components of biodiversity, must be recognised and taken into account in planning for biodiversity conservation efforts and to ensure fair and equitable sharing of biological resources.

7. An ecological approach to resource management is central to achieving biodiversity conservation and the sustainable use of biological resources.

8. Conservation of biodiversity should proceed on the basis of the best knowledge available, using approaches that can be refined as new information is gained.

9. Biodiversity conservation requires the cooperation of government and non-government organisations, resources users and the community in general.

10. Regional and international cooperative action and sharing of knowledge, cost, and benefits are essential to biodiversity conservation.

1.5 Biodiversity Assets

Being a relatively small country with a history of over three hundred years of extensive development, the island of Barbados has a limited stock of biological diversity and its existing natural habitats are constantly under threat from the encroachment of human development and other activities due to easy access to most remote areas. Development activities, including tourism developments, extensive residential and commercial development, rural subdivisions, and intensive mono-culture agriculture, are among the contemporary issues which have all contributed to the decline of the island's biodiversity.

Due to the limitation of forest cover and natural vegetation, terrestrial fauna in Barbados is severely limited. This fauna, comprising of mammals, birds, reptiles, amphibians and insects include species which are endangered, extant or rare. A general lack of knowledge of the ecology, habits and habitats of some of this fauna, together with the shrinking forest and vegetation cover, means that a considerable amount of research is required in order to conserve and protect these resources. In the following sections, a brief overview is provided on the biodiversity status of some of the major floral and faunal assets of Barbados.

1.5.1 Natural Vegetation

Three centuries of extensive and intensive development activities have denuded Barbados of most of its natural vegetation and consequently an important component of its biodiversity assets. Within 30 years of first settlement in 1627, about 80% of the forested area was cleared for agriculture (Watt,

1966). Since then, sugarcane was, and continues to be, the primary crop planted on the island. Gooding (1974) noted that, in the early 1970's, some 25,000 ha out of about 31,000 ha of arable land were under sugarcane cultivation. In 1989 arable lands accounted for about 17,000 ha (Ministry of Agriculture, Food and Fisheries, 1992), with sugarcane occupying about 11,000 ha. By 1996 sugarcane cultivation was further reduced to just under 9,000 ha. Abandoned sugarcane lands, particularly in the Scotland District, now have some secondary forest and regenerating natural vegetation.

Forests: Carrington (1991b) estimated the total tree cover of Barbados to be 2% of the area of the island or about 800 ha, which included gullies, coastal wetlands, undercliff woods and other planted wooded areas. Remnants of the xerophytic coastal forest can be found at Cluffs, Bath and Batts Rock and is essentially an inland extension of the Coccoloba association of the beaches and sandy bushland. The undercliff woods lie mainly on talus slopes at the base of the coralline cliff from Sealy Hall in St. John, around the rim of the Scotland District to Boscobel in St. Peter. The best development of the woods is behind Codrington College in St. John, then from Edgecliff passing below Hackleton's Cliff in St. Joseph to near Horse Hill and then clumps between Horse Hill and Boscobel Hill, near Bleak House, Farley Hill and at Cherry Tree Hill.

Turner's Hall wood (approx. 21 ha), in the Scotland District is perhaps the least disturbed wooded habitat in Barbados and is the best example of a Tropical Mesophytic (semi-deciduous) forest. There are two discernable canopy layers, occasionally a third layer consisting mainly of palms, a moderately developed evergreen shrub layer, a poorly developed herbaceous layer, poorly developed climbers and few epiphytes.

Endemic, Rare and Endangered Plants: There are about 700 species of flowering plants in Barbados with only two endemic species identified so far: *Phyllanthus andersonii* - a gully shrub, and *Metastelma barbadense* - a slender climber (Carrington, 1993), neither of which are rare or endangered. A recent study by Rogers (1999) indicates that the species *Agave barbadensis* - the maypole, commonly thought, until recently, to be endemic to Barbados, is really *Agave karatto,* found throughout the Lesser Antilles. Carrington (1991) indicated that there were 23 plants in Barbados that require protection, although all are found elsewhere in the Lesser Antilles. Fifteen of these species are known from only one site and eight species were considered rare or endangered in Barbados.

Bryophytes and Pteridophytes in Barbados have been documented but not much research has been conducted in comparison to the flowering plants. Coulter (1968) lists 37 species of ferns and fern allies for the country with only one endemic, *Adiantum tenerum* var. *farleyense,* commonly known as the Barbados Farley Fern. Pearce (1963), and Welch and Crum (1969) have collectively identified 22 species of mosses, four species of leafy liverwort and one hornwort. Carrington (1991) lists the following lower plants as rare or endangered: *Psilotum nudum* - a fern ally, *Adiantum tenerum* var. *farleyense*, and *Cyathea arborea* - a tree fern. A study by Rogers (1998) overturns

earlier evidence on the Barbados Farley fern. The Rogers study indicates that the Farley fern is neither a wild plant nor a variety; it is a cultivar. According to Rogers, the Farley Fern has no wild representation and probably never did. Further, being widespread in cultivation, it is not rare or endangered.

Major Impacts on Vegetation Biodiversity: The potential major impacts on current vegetation biodiversity are from tourism development and uncontrolled grazing of livestock. The construction of hotels and marinas, particularly along the west and south coasts, has reportedly caused the destruction of native plant communities and introduction of exotic species. Several proposals for the creation of golf courses were submitted by investors to the government for approval. The areas targeted for these facilities are likely to be abandoned agricultural lands, which are being recolonised with natural vegetation. The provision of housing and settlement expansion are likely to utilise marginal abandoned agricultural lands.

Free range grazing by cattle, sheep and goats, has been a historic practice in rural Barbados. No data was readily available that evaluated the extent and effects of this practice on selected natural plant communities in the island. Gooding (1974), however, suggested that grazing suppress the development of shrubs and trees in some gullies; this would allow grasses and other herbaceous plants to become dominant.

Agricultural Ecosystems: Agricultural production has been a primary occupation of Barbadians for hundred of years. The 1989 Agricultural Census recorded 17,178 agricultural holdings with a total area of 21,560 ha, distributed among the 11 parishes in the country (Ministry of Agriculture, Food and Fisheries, 1992) These holdings were categorized as producing either sugar, vegetables, root crops, fruits, livestock, poultry, mixed or other agricultural uses. These lands contain a wide variety of crops, fruit trees and other foliage which adds to the diversity of the agricultural resources. Given the high percentage of land under agriculture, these areas are responsible for providing a significant component to the islands' biodiversity assets.

Major Impacts of Agriculture on Biodiversity: Agricultural plantations over the last 300 years have reduced the extent of natural terrestrial ecosystems to relatively small isolated patches and created several monospecific agro-ecosystems, the most persistent of which has been sugarcane. This long history of intensive agriculture has contributed to the erosion of topsoil, decrease in soil fertility. Subsequently, large inputs of agrochemicals, particularly pesticides and chemical fertilisers, have been used as a means of maintaining productivity.

Agrochemical contamination of underground water supplies, near-shore waters and biota in Barbados, while not well documented presents a serious risk to human and animal health. The coralline nature of most of the soils in Barbados, coupled with discharge into subsurface water bodies as well as overland runoff, allow water to reach the sea in a relatively short time-frame. Consequently, prevention of contamination is difficult and mitigatory measures are likely to be too late to abate impacts.

1.5.2 Terrestrial Fauna

Compared to some of the larger islands of the Caribbean, the terrestrial fauna of Barbados is rather limited. Of the fauna surveyed, several species were identified as being indigenous to Barbados, while some have not been sighted for some time, leading one to conclude that they might be extinct. Loss of habitat and introduced species are both frequently sited as causes of biodiversity loss in Barbados. For the purposes of this research, the assessment of Terrestrial Fauna Biodiversity of Barbados has been largely restricted to mammals, birds, reptiles, amphibians and terrestrial invertebrates of social or economic importance, namely insects and allied arthropods.
***Mammals*:** The mammalian fauna of Barbados is dominated by mammals introduced since the island was colonized e.g. rats, green monkeys, hares and mongooses. The raccoon (*Procyon gloveralleni*) and the hare (*Lepus capensis*) are seldom found and the only extant indigenous mammals of Barbados are six species of bats, about which very little is known (Horrocks 1997). There is no protective legislation for mammals in Barbados, either for the species themselves or their habitats. Indeed, the Ministry of Agriculture has offered a bounty on monkey tails since 1975. Barbados is probably one of only a few countries in the world which offer a bounty for a primate species (J. Horrocks, pers.comm.).

Birds: The bird fauna of Barbados is much more diverse than the island's mammalian fauna. However, much of the diversity is attributable to seasonal migrants passing through the island on their way to the South American continent towards the end of the year. The resident bird species are relatively few by comparison, the numbers of species having declined primarily due to habitat loss following the island's colonization in the 1600s and through predation by introduced mammals such as the mongoose and the green monkey.

Watson (1993) reports at least 36 species of birds as resident and confirmed as nesting in the wild in Barbados, including the first record of breeding by the little egret (*Egretta garzetta*) in the Western Hemisphere. The thirty-six species include at least sixteen exotics, eight of which occur naturally due to expanded range (although some may have been unintentionally human-assisted), and eight of which have been human-assisted in their introduction.

Over 150 species of migratory birds have been recorded in Barbados, including seabirds (e.g. gulls and terns) and shorebirds (e.g. plovers and sandpipers). Barbados exists along a major migratory flyway for the eastern North American populations of many species of shorebirds heading for South America to breed and over-winter. Bad weather causes migratory birds to fly low over Barbados, and the presence of suitable aquatic habitat attracts the birds to land. Thirty-five of the more common shorebird species pass through Barbados between July and December.

Snakes: There is at least one species of colubrid snake in Barbados. In 1997, *Mastigodryas bruesi*, assumed for decades to be the endemic grass snake, *Liophis perfuscus,* was identified. The

previously recorded range for this sub-species is St. Vincent and the Grenadines. A confirmed sighting of *Liophis perfuscus* has not been made since 1961 (Emsley 1963). The worm snake, *Leptotyphlops bilineata*, has also been identified; this snake grows to about 9 cm and is dark brown with two yellowish stripes down its sides.

Lizards and Geckos: Lizards, confirmed as endemic to Barbados, are the tree lizard (*Anolis extremus*), and the leaf-toed gecko (*Phyllodactylus pulcher*). The ubiquitous *A. extremus* is the only anole in Barbados. Sightings of *Phyllodactylus*, the Barbadian leaf-toed gecko, has been reported in Ragged Point, St. Philip, but its range has not been systematically investigated.

Tortoises: Ray (1964) reported a giant tortoise, *Geochelone* sp. now extinct, from fossilised remains found at Spring Bay, St. Philip. For much of this century there has been a captive population of *Geochelone carbonaria* in Barbados. Captive tortoises (often marked for identification) frequently escape into the wild, but it is not known whether there are sufficient numbers of wild animals to form a breeding population, or whether the vulnerable hatchlings could survive predation pressure, particularly from the mongoose.

Turtles: There are two species of marine turtle nesting in Barbados. They are the **Critically Endangered** hawksbill turtle, *Eretmochelys imbricata* (IUCN, 1996), and the **Endangered** leatherback turtle, *Dermochelys coriacea* (IUCN, 1996). The Green Turtle *Chelonia mydas* is also known to forage in Barbadian waters. The hawksbill is valued for its meat, eggs and shell, and current estimates suggest that only fifty to sixty hawksbills nest in Barbados each year. Since there are 2-3 year gaps for an individual female between nesting seasons, this gives a total population of about 135 adult females nesting in Barbados (Horrocks 1992). Less than five leatherback females are estimated to nest in Barbados each year. The numbers nesting in Barbados may always have been small.

***Frogs and Toads*:** The Order Anura consists of frogs and toads. There are only two species of amphibians in Barbados, the cane toad, *Bufo marinus*, and the whistling frog, *Eleutherodactylus johnstonei.* Both species are thought to have been introduced.

Insects: Aside from investigations of pests of economic importance, their natural enemies and other associates, there have been few efforts to systematically collect any taxonomic groups of insects in Barbados. The most up to date list of insects and allied species of arthropods is that of Bennett and Alam (1985). Bennett and Alam's list includes approximately 1,320 species, which is three times the length of the list provided by Tucker (1952).

1.5.3 Marine, Fisheries and Freshwater Assets

The local marine and freshwater ecosystems support many habitats where a diverse collection of aquatic organisms interact with each other, feed, grow, reproduce and find shelter. These habitats

include wetlands and water catchments, rocky intertidal, tidepools, seagrass beds, coral reefs, and the deep water benthic communities which form part of wider marine areas inclusive of the Territorial Sea and Exclusive Economic Zone (EEZ). The information reviewed for this assessment indicates that 990 genera and 1548 species of organisms, including commercial fisheries resources, have been identified in the marine and freshwater ecosystems of Barbados. The diversity and survival of these organisms depend on the water quality of the ecosystems. However, there are several organisms that have not yet been identified to the species level.

Wetland Habitats. The Graeme Hall Swamp is the largest body of inland water in Barbados with the largest remaining area of red mangroves (*Rhizophora mangle*) and white mangroves (*Avicennia racemosa*). It provides a watering hole for many migratory birds and a permanent home for several resident birds including the locally rare and endangered red seal coot (*Gallinula chloropus barbadensis*) and the yellow warbler (*Dendroica petechia*). The Graeme Hall Swamp also serves as a sanctuary for juveniles of marine fish. Biodiversity for Graeme Hall Swamp includes several species of fish, crustaceans, insects, amphibians and aquatic flora.

There are also smaller wetlands at Chancery Lane, Christ Church and at Long Pond, St. Andrew. There are a number of permanent surface catchments, the major ones being: Bawdens, Long Pond, Green Pond, Hillaby, Bathsheba, Conset, Codrington, Three Houses and Culpepper.

Known biodiversity in permanent and temporary freshwater catchments include several species of shrimp. Other than Felix (1991) who studied Freshwater Shrimps of Barbados, and the Cattaneo (1987) study of the Graeme Hall Swamp, there have been no other detailed studies of the biodiversity in the fresh and brackish water catchments. Biodiversity reported for the Careenage includes several species of Foraminiferans, Sipunculids, Mollusks, Annelids, Crustaceans and Echinoderms.

Rocky Intertidal Areas. The intertidal area is that area that straddles the marine and terrestrial habitats where the shore is washed by the sea at low or high tides. Organisms inhabiting the intertidal areas are exposed to harsh and highly variable conditions such as heavy wave action, periodic desiccation and high temperatures. The intertidal area in Barbados may be categorized as sandy or rocky. The rocky shores predominate along the north and southeast of the island, while the rest of the coast is dominated by sandy shores, interrupted occasionally by rocky areas. In some rocky areas there are limestone platforms that retain water at low tide to form tidepools. Both the rocky areas and the tidepools provide habitats for a diverse collection of living organisms. Lewis (1960) reported three categories of local rocky cliffs, pebble beaches and low-lying platforms.

Seagrasses are marine flowering plants with extensive root and rhizome systems, dense leaf development and high growth rates, (Vermeer, 1997). Four species of seagrasses have been reported for Barbados (Delcan 1994, Vermeer 1997). There are *Thalassia testudinum* (turtle grass), *Syringodium filiforme* (manatee grass), *Halodule wrightii* (shoal grass), *Halophila* sp.. Seagrass areas, like coral reefs, are highly productive areas.

The ***Coral reef*** communities are of immense ecological and socio-economic importance to Barbados. Ecologically, the coral reefs contribute significantly to the national biodiversity by providing shelter, feeding and breeding grounds, recruitment sites and nursery grounds for a diverse collection of adult and juvenile marine organisms. In addition the coral reefs contribute to food supplies by supporting several commercial fisheries. Socio-economically, the coral reef communities with their diverse marine life and associated white sand are of tremendous aesthetic, recreational and educational value to both visitors and locals.

Fringing reefs are found in shallow waters (less than 30 m) primarily along the west coast and to a lesser extent along the southwest coast as mostly relic reefs. The fringing reefs extend seaward from headlands for as much as 100 - 200 m and are separated from each other by sandy patches. The fringing reefs generally have three (3) distinct zones - back reef, reef flat, and the spur and groove zone.

Patch reefs are found on all coasts in 5-40 m of water. Patch reefs vary in size from a few coral heads to structures of hundreds of metres in diameter. They are three types of patches based on their coral composition - mono-species hard coral, multi-species hard coral and multi-species soft coral.

The ***Bank reefs*** are found along the south and west coasts between 500 and 1000 m from shore, at depths ranging from 15-33 m and they cover an area of 4.9 km^2. The west coast bank reefs are usually found in deeper water than those on the south coast. Bank reefs are characterised by a narrow crest and steep landward and seaward slopes. They support rich and diverse colonies of hard and soft corals; a high density of sponges and fish; and a low density of macroalgae.

The East Coast Marine Habitat. Ten habitat types with a relatively rich and diverse collection of flora and fauna were identified for the east coast. These habitat types are; intertidal bare sand, seagrass, coral rubble, brown algal pavement, gorgonian pavement, broken gorgonian pavement, broken algal pavement, hard coral reef slope and scouring rock habitats.

Deepwater Marine Benthic Communities. Lewis (1965) identified the following three (3) benthic communities; a sponge and coral community, a community rich in coelenterates, mollusks and echinoderms and a community dominated by mollusks.

Fisheries Resources

The local fishery may be divided into four groups, based on the area in which the fish are found. These are ***nearshore reef resources, offshore reef resources, coastal fish resources*** **and** ***offshore pelagic fish resources.***

Nearshore Reef Resources.

Nearshore coral reefs provide habitat for many of the fish species that are harvested by fishers. The main fisheries are the shallow-shelf reef fish, sea urchins, turtles and lobster. Small quantities of conch are also harvested.

Shallow-shelf reef (trap or pot) fishery. The main inshore fishery resources are the fish on the fringing reef and in the seagrass beds, mainly along the south and west coasts of the island. The shallow-shelf reef fish are harvested mainly by traps and to a lesser extent handlines and seine nets. Small, open boats with outboard engines (moses) are the most commonly used vessel in harvesting shallow-shelf reef fish. Dynamite, poison and noxious substances, though prohibited under the Fisheries Act (1993-6) are used occasionally in harvesting. The potential yield is unknown due to lack of accurate time series biological or catch and effort data. The shallow-reef fish resources are believed to be overfished, particularly those on the south and west coasts, where fishermen have reported reduced catch per unit effort, reduced fish sizes and few large species in their catch.

Sea Urchin Fishery. The main landing sites for the sea urchin or sea egg *Tripneustes ventricosusis* sp. are located on the east and southeast coasts and to a lesser extent on the northwest coast. Both sexes are harvested for their gonads which are considered to be a delicacy. Sea urchins are harvested close to shore by skin divers using mask, snorkel and fins or by SCUBA divers. The sea urchin has been largely overfished resulting in the suspension of this fishery.

Spiny Lobster. Lobsters are commonly found among the rocks and coral rubble at depths of about 4 to 20 m, on the shelf and slope habitats. Juveniles inhabit shallow coastal habitats such as seagrass, mangrove and coral rubble in protected bays. As the juveniles grow older and larger they gradually move into deeper water and offshore reef habitats. The lobster fishery is a minor fishery. Lobsters are captured mainly along the east coast by skin or SCUBA divers using spears. The potential yield of the local lobster fishery is unknown. No biological or catch and effort data are collected by Fisheries Division. However, anecdotal information suggests a possible increase in abundance in recent years.

Sea Turtles. The hawksbill (*Eretmochelys imbricata*) and the leatherback (*Dennochelys coriacea*) nest on local beaches, while the green turtle (*Chelonia mydas*) and the loggerhead turtle (*Caretta caretta*) are found occasionally in local waters. This is a minor fishery of little economic importance. Stocks are severely overexploited and, in some cases, threatened with extinction. The selected management approach as outlined in the Fisheries Management Plan is the indefinite prohibition of harvesting of sea turtles and their eggs and the indefinite prohibition of the sale of turtles and turtle products. All turtles found in Barbados are on the list of endangered species included under the Convention on International trade in Endangered Species of Wild Fauna and Flora (CITES) to which Barbados is signatory.

Conch. Small quantities of two species of conch are harvested in Barbados. The queen conch (*strombus gigas*) is harvested mainly along the south coast. The helmet shell conch (Cassis madagascariensis) is harvested along the northwest coast. Both species are harvested for the flesh

and shell. There is no accurate information on the status of the local species of conch. However, the queen conch population is believed to be depleted and restricted to deep waters while that of the helmet shell conch is restricted to the northwest coast in relatively shallow waters.

Offshore Reef Resources

Snapper Fishery. The snapper fishery targets snappers on the deep-slope and bank reefs, especially, on the south and west coasts. Handlines are used to fish queen snappers (*Etelis oculatus*) and vermilion snappers, (*Rhomboplites aurorubens*), while traps set on the slopes and banks are used to target silk, *(Lutjanus vivanus*), and vermilion snappers. The annual estimated catches for the period 1986-95 ranged between 30 to 60 MT (Fisheries Division, 1997), with no clear trends. These resources are considered as under-exploited. Rough estimates of the total potential yield from the slopes of Barbados indicates 18 to 80 tonnes/year (FAO, 1990). Snappers are highly priced and high demand species.

Coastal Fish Resources

This fishery targets the fish resources within 2 km from shore. Most of the catch is used as bait in other fisheries while some are used as food. Fish are caught using seinenets, castnets and trolling from "moses" or launches. The status of the coastal pelagic resources is unknown. Annual estimated catches of jacks and small tunas from 1986-95 ranged from about 8 to 40 MT with no clear trends

Offshore Pelagic Fish Resources

Large Pelagic Fishery. The large pelagic fishery is an offshore fishery. The large pelagics are believed to be of two groups: Caribbean stocks which migrate within the Lesser Antilles; and Western Atlantic stocks or oceanic stocks which extend throughout at least the Western Atlantic. This fishery provides employment for an estimated 3,000 persons and involves some 400 fishing vessels. The fishing methods include the traditional trolling and lurk-lining, and the recently introduced longlining. The International Commission for the Conservation of Atlantic Tunas (ICCAT) reports that many of the large tuna species, in the Atlantic in general, are either fully exploited or overexploited. The status of most other tuna and tuna-like species in the Western Atlantic and Caribbean is uncertain.

Flyingfish Resources. The flyingfish fishery is the "mainstay" of the local fishing industry. Flyingfish account for over 50% of total landings in most years. The fishery provides employment for an estimated 3,000 persons and involves some 400 fishing vessels. Annual estimated catches of flyingfish between 1986 and 1995 ranged from about 1200 to 2800 MT. The effort directed at flyingfish increased since the 1980's by expansion of the number and the capacity of flyingfish vessels. The flyingfish fishery targets four-winged flyingfish *Hirundichthys affinis* comprise over

90% of the flyingfish catch. The by-catch comprises margined flyingfish or guineaman *Cypselurus cyanoptenis* and turpits - *Canthidermis* sp.

Marine Mammals. The information on the marine whales is based on unpublished data collected by Julia Horrocks of the University of the West Indies. Barbados does not have a resident population of whales, however several species are known to migrate through the water of Barbados. There was once a local whale fishery.

Major Impacts on Marine Biodiversity: There are indications that the marine, and possibly the freshwater, ecosystems are under stress. The near-shore benthic marine communities are being degraded primarily by deteriorating water quality, arising mainly from increased sedimentation, eutrophication and sewage pathogens, localised increases in temperature, decreases in salinity, over fishing, physical damage (Delcan, 1994a) and use of destructive fishing methods, such as dynamite. Delcan (1994a) identified surface water runoff and groundwater discharge as the main mechanisms by which terrestrial pollutants (nutrients, suspended solid material and sewage pathogens) enter the marine environment. By extrapolation, it is likely that similar pollutants are also entering the water catchments, since the catchments also receive water from surface water runoff and groundwater discharge.

1.5.4 Land & Agricultural Resources

The island's land resources are constantly under threat from the encroachment of human activities. Developments including, but not limited to, golf courses (and other tourism development), scattered residential and commercial development occurring out side of the "Urban Corridor", rural subdivisions, and intensive mono-culture agriculture, are among the contemporary issues with the potential to impact negatively on the islands' biodiversity. These issues, coupled with the islands relatively scarce land resource endowment creates an even greater need for specific strategies to conserve biodiversity in Barbados.

Areas of regenerating vegetation and open space linkages are generally natural features such as gullies, escarpments, uncultivated open lands and other areas of contiguous or associated vegetation. These areas have been traditionally undervalued in terms of importance in supporting biodiversity, this is generally due to the lack of awareness, and information supporting the relative importance of these open lands. The fact that these open spaces are usually the first areas earmarked for development should no doubt warrant further research in order to re-evaluate some of these lands in terms of ecological value.

The 1989 Agricultural Census recorded 17,178 agricultural holdings with a total area of 21,560 hectares, distributed among the 11 parishes in the country (Ministry of Agriculture, Food and Fisheries, 1992). These holdings were categorised as producing either sugar, vegetables, root crops, fruits, livestock, poultry, mixed or other agricultural uses.

The land occupied by agriculture in Barbados is about 50% of the total area of the island. Arable land is considered as land capable of being cultivated and having some from of production. It is comprised of land under temporary crops (< 1 year), temporary pasture (< 5 years), temporarily fallow (< 5 years), permanent crops and all other arable land, which together occupies about 82% of holdings recorded in the 1989 agricultural census. The rest of the holdings were under permanent pasture, wood or forest, disused and potentially productive land and land with buildings and roads. Production surveys done by the Ministry of Agriculture and Rural Development show an increase in the area under vegetable production and a decrease in sugar production over the past few years.

Crops Grown: "Agriview 1995", the agricultural report of the Ministry of Agriculture and Rural Development for 1995, records some statistics for the following crops: sugarcane, cotton, root crops, corn, onions, other vegetables, bananas/plantains/figs, other fruits and cut-flowers and foliage. Production surveys done by the Ministry of Agriculture and Rural Development have indicated an increase in the area under vegetable production and a decrease in sugar production over the past few years.

Sugarcane: The West Indies Central Sugar Cane Breeding Station (CBS), located in Groves, St George, is funded by Caribbean sugarcane growers and is responsible for producing disease resistant, high yielding commercial varieties of sugarcane. Its Genetic Base Broadening programme runs concurrently with its Commercial Crossing programme, utilising *Saccharum officinarum* and *S. spontaneum* as the main donor species, and to a lesser extent, *S. robustum* and *Erianthus arundinaceus*. About 30,000 varieties have been bred and are being tested for commercial application by the Agronomy Research and Variety Testing Unit of the Barbados Agricultural Management Company Limited. Over the past 21 years sugarcane breeding has produced about 20 million genotypes which are kept in cold storage. About 2600 accessions are kept in field plots, of which 12 varieties have found commercial application in Barbados over the past decade

Other Crops: There is no national programme for conserving plant genetic resources in Barbados (Wickham, 1995), however, other than the activities at the CBS, sweet potato conservation is done by both the Ministry of Agriculture and Rural Development and the Caribbean Agricultural Research and Development Institute (CARDI). Cassava, yam, pineapple, onion, pigeon peas, and maize germplasm are also conserved by CARDI. Fruits and cut flowers conservation is done by the Ministry of Agriculture.

Cut Flowers and Foliage: An estimated 25.1 ha were under cut-flower and foliage production in 1995 as compared to 24.2 ha in 1994 (Agriview 1995). Cut flowers were sold mainly to hotels and florists during the tourist season. In addition, MEE records indicated that 80,987 ornamental plants listed in the Appendix 1 and 11 of CITES were imported into the country in 1996, primarily for trade and personal use.

Livestock: Stock for many of the breeds of commercially important animals have been imported, however, for cattle and goats much of the local stock are considered as "creole", which resulted from uncontrolled cross breeding and having no easily determined major pedigree. The following commercial breeds of livestock are available in Barbados:

Chicken:	Layers - White Leghorn, Rhode Island Red Broilers - Commercial hybrids from imported eggs, hatched locally
Cattle:	Dairy - Holstein, Jersey, Creole Beef - Red Poll, Holstein, Red Poll/Holstein
Sheep:	Barbados Black Belly, Black Belly types
Goats:	Creole, Sanaan, Toggenberg, British Alpine, Anglo-nubian, French Alpine
Pigs:	Large White, Landrace, Duroc

Major Land Use Issues Affecting Biodiversity in Barbados. The major contributing factors to the loss of biodiversity in Barbados are habitat loss and fragmentation. Habitat disturbance does not only precipitate loss of species, it also represents a loss of biodiversity in its own right. Habitat loss is an on-going threat to biodiversity in Barbados. During colonial times substantial vegetation was cleared for agricultural purposes, building materials and fire wood. More recently vegetation loss has resulted primarily from clearing to facilitate residential development, the largely *ad hoc* urbanization process and the construction of tourism sector developments such as hotel and golf course facilities.

Other factors contributing to the loss of biodiversity include resource extraction, primarily for oil and gas, quarrying, and sand mining, intensive monoculture agriculture, and urban sprawl. In this regard, concerns have arisen as productive lands, especially agricultural lands are lost to seemingly higher value uses such as residential and golf course developments. If this trend continues, in the absence of a strategy for managing the impacts on biodiversity, one likely result is the loss of unique plant and animal species which are now important for agricultural production.

In 1997 GOB commenced work on the revision of the National Physical Development Plan (NPDP). This plan which was completed in 1999 recommends the establishment of a nation-wide system of parks and open spaces to ensure the protection and conservation of national and cultural assets, while supporting the social and economic development of existing communities within the park boundaries. The national open space system comprises six open space categories (**OS1:** ***The Barbados National Park;*** **OS2:** ***Natural Heritage Conservation Areas;*** **OS3:** ***Coastal Landscape Zones;*** **OS4:** ***Public Parks and Open Spaces;*** **OS5:** ***National Attractions; and*** **OS6:** ***Barbados National Forest Candidate Sites***).

In particular, the *OS1, OS2, OS3 and OS6* areas posses immense value in terms of their *in situ* conservation of Barbados's biological diversity. These proposed designated parks and open spaces

contain many natural features supportive of natural habitats. It is envisioned that the official designations of parks and open spaces as natural preserves, would result in greater regulation of human activities and which may adversely impact on existing biodiversity in these marine and terrestrial areas. Other areas which were identified as being significant in terms of biodiversity include Graeme Hall Swamp, Turners Hall/Hackletons Cliff, Walkers Sand Dune, Long Pond Estuary, the Chancery Lane Wetland and Sand Dune features, and the islands extensive Gully network.

Major Impacts of Agriculture on Biodiversity

Agricultural plantations over the last 300 years have reduced the extent of natural terrestrial ecosystems to relatively small isolated patches and created several monospecific agroecosystems, the most persistent of which has been sugarcane. Of the 25 food crops monitored by the MARD, only 15 of these occupied arable land greater than 100 ha by 1996. This long history of intensive agriculture has contributed to erosion of topsoil, decrease in soil fertility, and subsequent large inputs of agrochemicals, particularly, pesticides and chemical fertilizers as a means of maintaining productivity. Due to the coralline nature of most of the soils in Barbados, percolation of water and subsequent discharge into subsurface water bodies as well as overland runoff, eventually reaches the sea in a relatively short timeframe. Agrochemical contamination of underground water supplies, nearshore waters and biota are not well documented for Barbados but presents a serious risk to human and animal health.

Agricultural research is contributing to an increase in the number of genomes of selected food crops for commercial exploitation, grasses for pasture improvement, and the propagation of helpful parasites for biological pest control. The MARD is conducting research focused on finding solutions to a number of pests and disease problems in fruits and vegetables, breeding and crop improvement of the Sea Island Cotton cultivars, and the utilisation of pasture grasses such as Pangola, African Star, Coastal Bermuda, and Coast Cross.

1.6 Policy, Legislative and Institutional Framework for the Conservation of Barbados' Biodiversity

Programmes for the conservation, study and sustainable use of biodiversity require a clearly articulated policy and an adequate supportive legislative framework, both of which, until recently were non-existent or inadequate. In the absence of a clearly articulated national biodiversity policy, the legislative regime, comprising of both national and international, provide an expansive set of tools which can provide the protective regime required to achieve the objectives of biodiversity conservation. However, given the perennial concern of enforcement capacity, the effectiveness of these instruments are usually thwarted. In the following sections a review of the policy, as well as the international and national instruments are examined to assess their adequacy in helping to achieve the goals of biodiversity conservation.

1.6.1 Policy for Biodiversity Conservation and Sustainable Use

Prior to the preparation of the NBSAP there were no comprehensive national policy on the management of biodiversity in Barbados. However, measures to overcome this deficiency have been addressed through the preparation of the NBSAP and through other national studies which seek to preserve and protect the naturel and environmental resources of Barbados. In the Draft NBSAP the policy on biodiversity conservation is enshrined in the mandate given to the newly established *Policy and Coordination Unit* and the *Natural Heritage Unit* within the Ministry of Environment, Energy and Natural Resources.

As the lead agency for coordinating the implementation of the Biodiversity initiative *The Policy and Coordination Unit* is expected to provide a strong focus for the development and implementation of international and national environmental policies, is mandated to develop the mechanisms whereby the Ministry can adopt a coordinated approach to dealing with environmental policy issues and to advise on and articulate such policy. The *Conservation and Biodiversity Section* within the *Natural Heritage Unit*, on the other hand, is entrusted with the mandate to manage policy implementation related to conservation of natural and heritage resources. This includes the production of operational guidelines and the compilation of a database on biodiversity inclusive of a survey of local flora and fauna and the establishment of a species management plan.

In addition, to the above, several other studies and development plans now contain strong statements of intentions to protect and conserve biodiversity. These include the following:

(1) The ***Draft National Physical Development Plan (NPDP, 1998)*** which was produced under EMLUP defines the following objectives with respect to achieving the goal of enhanced biodiversity conservation and management:

   (1) To protect and enhance the quality of the natural environment through: soil and ground water conservation; protection of the biodiversity of beaches and reefs; and prevention of air, land and water pollution;

   (2) Establish National Heritage Conservation Areas for the protection of significant ecosystems such as remnant forests, wetlands, dunes, savannahs, and marine features;
   (3) Protect, maintain and enhance natural heritage features in urban environments and seek to minimize adverse impacts arising from new development; and
   (4) Plan, develop and manage settlement and land use systems in a manner which takes into account risks of natural and man-made disasters and coastal erosion. (NPDP, 1998)

Other specific references to conservation of biodiversity include:

(1) Preservation of vegetation through incentives to increase tree cover in urban, rural and coastal areas;

(2) Creation of Barbados National Forest Candidate Sites and protection of Existing Forests, Emerging Forests and Forest Linkages in the National Park;

(3) Restriction on development in forested gullies

(iv Requirements for tree preservation and replacement plans as part of the supporting documents for all development in the Integrated Coastal Zone Management Area, and enforcement of the Tree Preservation Act.

(2) The ***Environmental and Natural Resources Management Plan*** which was also prepared as part of the EMLUP study identified several initiatives which directly and indirectly will result in biodiversity conservation. These include the following:

(5) Maintaining ecological viability of remaining natural habitats which are represented generally in small isolated areas such as: areas of natural forest (e.g. Turners Hall Woods, Hackleton's Cliff, Foster's Funland, Archers Bay, Consett Bay), gullies (e.g Jack-in-the Box and Welchman Hall), and dunes (e.g. Walkers Dune/Savannah, which is subject to sand mining).

(6) Maintaining the integrity of scenic vistas and areas, including the Scotland District, ridges, caves, coastal cliffs and public parks.

(7) Preserving critical habitats for migratory and nesting species, as well as indigenous species including wildfowl, sea turtles and snakes.

(8) Rehabilitating degraded natural systems including gullies, forests, and dune areas.

(9) Establishing measures to control the harvesting of threatened species including sea turtles and snakes.

(10) Establishing measures to control shooting of birds over ponds.

(11) Improving enforcement measures to control the felling of trees during construction and land clearance activities.

(12) Controlling the setting of fires, including those set deliberately to assist with the clearing fields for cultivation.

(13) Controlling the export of terrestrial and marine rare and endangered species.

(14) Controlling the importation of non-indigenous species of flora and fauna.

(3) The ***Coastal Zone Management Plan (CZMP, 1998)*** and the Coastal Management Act provide for the conservation and management of coastal and marine biodiversity through several statutory and policy mechanisms. In addition the plan designates marine reserves, which may include submarine areas, along with adjacent land that is ecologically linked, as restricted areas.

The CZMP makes provision for the conservation and management of Natural Heritage Conservation Areas (OS 2) and Coastal Landscape Protection Zones (OS 3) which are established in the NPDP. Within the OS 2 designation there are marine/coastal areas of special environmental and ecological areas regarded as Special Study Areas, for which comprehensive management plans are proposed to be undertaken. These include the Graeme Hall and Chancery Lane wetland systems; Long Pond, Green Pond, Consett Bay and Walkers Dune/Savannah. Two areas outside of the National Park are assigned OS 3 designations. These include sections of St. Lucy and St. Philip's coastal zone. The CZMP outlines the following policies related to the conservation and management of marine/coastal biodiversity resources:

(i) Increased setbacks from cliff edges as modified by the East Coast Integrated Coastal Zone Management Project;

(ii) Preservation of existing vegetation by landowners through encouragement from the CZMU;

(iii) Permitted uses within these zones are set out in the Land Use Plan;

(15) Protection and rehabilitation guidelines for coastal and marine habitats including: reefs, seagrass beds, ravines, and other freshwater ecosystems and littoral vegetation;

(16) The provision of policies for the detailed management of the Folkstone Marine Park and the proposed marine park at Carlise Bay;

(17) Cooperation between the CZMU and the Fisheries Division with regard to the implementation of the CZMP provision for the regulation of the shallow-shelf reef fishery and fisheries for small coastal pelagic species, and coastal habitats including reefs and segrass areas;

(18) Protection and management of turtle nesting sites through mechanisms which include enhancing beach management in relation to sand mining, pollution

monitoring, setbacks and other coastal planning regulations related to the construction of enclosures and fences and other physical structures, appropriate lighting in upper beach areas, controlled vehicular beach access, in addition to replanting and protection of littoral vegetation. Further policies are proposed to be developed by the CZMU with technical input from the Widecast Sea Turtle Recovery Action Plan for Barbados and CITES; and

(19) Determination of threshold levels for marine water quality with regard to discharges including suspended sediments and contaminant loadings.

(4) ***Fisheries Management Plan*** makes provision in its fisheries management and development policy plans for the conservation of marine biodiversity and the protection of the marine environment. These include:

(i) Ensuring that the fishing industry is integrated into the policy and decision making process concerning fisheries and coastal zone management;

(ii) promoting the development and use of selective fishing gear and practices that minimize waste in the catch of target species and minimize by-catch of non-target species;

(iii) ensuring effective monitoring, control and surveillance of fishing activities;

(iv) protecting and restoring populations of endangered marine species; and

(v) preserving rare or fragile ecosystems and ecologically sensitive areas, in particular, coral reefs, estuaries, mangroves, seagrass beds, spawning and nursery areas.

Status of these Sectoral Plans

The various sectoral sectoral plans which were undertaken by the government are at different stages of implementation by the relevant agencies and departments responsible for the execution of these plans. The GOB is presently examining the Environmental Management and Land Use Planning for Sustainable Development (EMLUP) 97/98 proposal for the development of national parks legislation. This would offer greater protection to the preservation of rare or fragile ecosystems, as well as the habit of depleted, threatened or endangered species in accordance with the SPAW Protocol.

Final documents have for the various studies under EMLUP have been submitted for review by various government agencies to date. The Draft NPDP (1998) is currently being revised to be presented for approval by the cabinet.

1.6.2 International Agreements

International agreements have served as catalysts for much of the effort being expended in many countries of the world for conservation and protection of the environment and of natural resources. The CBD is now the key coordinating, catalysing and monitoring mechanism for international biodiversity conservation. However, there are several other 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 island has obligations to implement rules for the preservation of biological resources. From a legal perspective, implementation is by way of the passage and enforcement of legislation and regulations. From an administrative perspective, new procedures and mechanisms would have to be employed to facilitate the implementation of biodiversity programmes. In respect of conventions signed by Barbados, but which have not yet entered into force, the island has the obligation to refrain from acts that would defeat the object and purpose of the treaty. The most relevant of these international agreements are as follows:

The ***United Nations Convention on Biological Diversity*** was adopted on June 5, 1992, in Rio de Janeiro, at the end of the United Nations Conference on the Human Environment. The CBD entered into force on December 29, 1993 and Barbados became a party to the Convention on December10, 1993. There is no legislation that comprehensively implements the CBD. The Government of Barbados (GOB) has commissioned the preparation of a "Draft Environmental Management and Conservation Act for Barbados" for this purpose. More broadly, the Ministry of Environment, Energy and Natural Resources has received the Environmental and Natural Resources Management and Land Use Planning for Sustainable Development Report (1997/98), (EMLUP Report 97/98), which makes recommendations for the drafting of related legislation and the establishment of institutions and mechanisms to assist in the protection of biological diversity.

The ***Convention on Trade In Endangered Species*** (CITES), was concluded on March 3, 1973 in Washington and entered into force on July 1, 1975. Barbados became a party to this convention on December 9, 1992. Barbados makes annual reports to the CITES Secretariat regarding measures taken to implement the Convention. Responsibility for the enforcement of this convention rests with various Ministries and Departments, including, Ministry of Agriculture and Rural Development; The Ministry of International Trade and Business; and The Ministry of the Environment, Energy and Natural Resources.

Relevant legislative provisions are scattered throughout a number of statutes including: the *Fisheries Act 1993 (6/1993)*, which protects such species as turtles and whales; the *Wild Birds Protection Act (cap. 398),* which protect birds such as the parrots; the *National Conservation Commission Act 1982 (cap. 393);* and the *Marine Areas (Preservation and Enhancement) Act (cap. 392)* which together offer some protection for some species of plant and other marine life, in so far, as they place restrictions on the trading of the resources addressed in the respective pieces of legislation. Administrative measures taken include the training of Custom Officers and relevant private sector personnel (e.g., pet shop owners), and the operationalisation of the import/export permit system. Both initiatives took place in February 1998.

Barbados signed the Final Act (only) of the ***Protocol (to the 1983 Cartagena Convention,* see below*) Concerning Specially Protected Areas and Wildlife in the Wider Caribbean* (SPAW)** which was adopted in Kingston on January 18, 1990, and came into force in June 2000. Strictly speaking, therefore, Barbados is under no legal obligation to implement the SPAW Protocol or to refrain from acts which would frustrate the object and purpose of the agreement. However, the Protocol covers the same matters as the CBD in respect of which Barbados has international obligations. The Government is actively considering the acceptance of the SPAW Protocol and hopes to reach a decision by year end (John Wilson, Pers. Comm.).

The ***Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region*** (*Cartagena Convention*), and the ***Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean Region, (Oil Spills Protocol),*** were concluded in Cartagena de Indias on March 24, 1983. They entered into force on October 11, 1986. Barbados became a party to the Convention and Oil Spill Protocol on March 28, 1985. The executing agencies in Barbados are the Ministry of Environment, Energy and Natural Resources, the Ministry of Agriculture, and the Ministry of Shipping. The GOB participates in the biennial meetings of the Contracting Parties which acts as a forum for the communication and exchange of information regarding measures taken to implement the Agreements.

Although there is no legislation specifically geared towards the implementation of these legal instruments, a contingency plan exists to deal with oil spill emergencies, and the GOB has promoted the identification and development of the capability to respond to an oil spill incident and the designation of an authority responsible for the implementation of the protocol.

The ***United Nations Convention on the Law of the Sea*** (UNCLOS), signed on December 10, 1982, in Montego Bay, entered into force on November 16, 1994. The Convention is relevant to biodiversity because it prescribes jurisdictional rules for the protection of resources found in the marine environment.

Barbados became a party to this Convention on October 12, 1993. There are no regular meetings of parties to review implementation of the environmental regime. Responsibility for the implementation of this Agreement is shared by the Ministry of International Trade; the Ministry of Agriculture and Rural Development; and the Ministry of Environment, Energy and Natural Resources.

Barbados has taken action to implement the UNCLOS regime on jurisdiction, competence and sovereignty and sovereign rights, over such zones as the internal waters, territorial sea and the exclusive economic zone. Relevant legislation includes: the *Barbados Territorial Waters Act 1977 (cap. 386)* and the *Marine Boundaries and Jurisdiction Act 1979 (cap. 387),* and the *Shipping (Oil Pollution) Act 1994 (1994-16).*

The GOB intends to enact the "Marine Pollution Control Act". This is a broad marine pollution statute which is crafted to protect various elements of biological diversity in the maritime zones of the Island.

1.6.3 National Legislation

Barbados has no legislation in force, which has been designed specifically to deal with the protection of biodiversity, in response to the country's ratification of the 1992 Convention on Biological Diversity. However, several statutes, charging various government bodies with the management of the environment, including biological resources are dispersed in various pieces of legislation. In addition, legislation is currently being drafted that addresses exotic species. There is also currently no comprehensive legislation in Barbados governing protected areas. Preservation and conservation of ecologically important areas is undertaken in a piecemeal fashion. The most prominent pieces of legislation providing statutory protection of the environment are described in the following section.

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, archeological 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.

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 Marine Areas (Preservation and Enhancement) Act (cap.392) makes provision for the protection of coastal and marine areas and the regulation of the establishment of the underwater parks and art centres in marine areas.

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; advising on the removal of coral from the ocean bed; regulation of 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 CTP.

The Cultivation of Trees Act (cap.390) promotes the cultivation of specific species of trees through the financial incentive of receiving a tax credit.

Agriculture/Livestock

The Barbados Agricultural Development and Marketing Corporation (BADMCA) (12/1993) establishes the BADC 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.

Marine Resources

The ***Barbados Territorial Waters Act 1977 (1977-26)*** 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 sea-bed and subsoil, form part of the territory of Barbados and are, therefore, subject to full territorial sovereignty.

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.

Under ***The Marine Areas (Preservation & Enhancement) Act 1976 (MAPEA) (cap. 392)*** the (Designation of Restricted Order 1981 (30/1981) and the Barbados Marine Reserve) Regulations 1981 (28/1981) have been enacted. The MAPEA contains substantive environmental regulation including protection of the coastal and marine areas and regulates the establishment of the underwater parks and art centres in marine areas.

The ***Fisheries Act (1993-6)*** came into force on October 1, 1993. It consolidates previous statutes on the countries fisheries. The Act contains provisions for fisheries management and development in accordance with statutory schemes. Provision is also made for access by foreign vessels in accordance with access agreements and licencing procedures for local and foreign vessels.

Protection of Wild Flora and Fauna

The National Conservation Commission Act 1982 (cap. 393) relates to flora and fauna found in caves, however, Barbados has no legislation for the general protection of wild fauna and flora. Some species of wild flowers are worthy of protection in respect of which no legislation obtains. Similarly, there is no broad regulation of the international trade in endangered species as required in international conventions such as CITIES. Legislation protecting special areas and wildlife is in evidence, however there is need for comprehensive regulation which incorporates suitable provisions for management plans and protection of intellectual property rights.

The Wild Birds Protection Act 1907 (cap. 398) **(WBPA)** provides for the protection of some thirty (30) 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 birds 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.

1.6.4 Legislative Requirements

A review of existing legislation, relevant to the management and conservation of Biodiversity, identifies the need for a legal regime to be developed, which would give a comprehensive response to the requirements for the protection of biological diversity. The concept of the protected area, as developed in international instruments to which Barbados is a party, including the CBD and the SPAW Protocol, requires articulation in statute, as does the basic tool of the management plan

designed to achieve specified conservation objectives. These measures must find expression in a comprehensive environmental enactment which would include existing natural resources legislation.

In developing this comprehensive legal response the following environmental issues should be considered:

- Legislation pertaining to wildlife protection is antiquated and requires a complete revamping in order to protect indigenous species, regulate the international trade in endangered species and give effect to Barbados acceptance of the CITES convention.
- General regulation of the release of pollutants into the environment that causes, amongst other things, contamination of biological resources, is required. In this regard, substantially new legislation is required for waste management, toxic substances, noise, air pollutants, climate change, and dumping.
- EIA procedures need clear legislative authority.
- Planning legislation should be modified to attempt to ensure greater transparency and closer relationship between the grant of planning permission and the requirement of conformity with the Physical Development Plan.
- National parks legislation is required.
- Forestry legislation is required.

As noted above, the Government of Barbados is reviewing the EMLUP Report which has suggested the enactment of several environmental statutes most of which will be critical to effective protection of biodiversity. Also, the proposed "Draft Environmental Management and Conservation Act for Barbados" contains provisions for the implementation of the CBD and the SPAW Protocol. It also makes provision for designation of specially protected areas, including the Scotland District and coastal planning areas.

In the "Revised Town and Country Planning Act" extensive revisions have been made to the existing planning legislation. These revisions addresses the aspects of the legislation, discussed above, which inhibit its effective protection of bio-diversity.

1.7 Institutions and Other Partners Involved in the Conservation & Management of Biodiversity in Barbados

In Barbados, the responsibility for the management of biological resources is fragmented among several Government Ministries. There are also a number of non-governmental organisations and

entities involved in the conservation of biodiversity. The fragmentation of biodiversity responsibilities has evolved into a situation whereby a myriad of institutions and agencies have their own legislative mandate, administrative procedures, resources, work programmes and priorities. There is often insufficient communication between these organisations and coordination of their activities. Hence, there is frequent duplication of effort and no clear jurisdiction in biodiversity management matters.

Despite these obstacles, personnel within these institutions and agencies are cognizant of the need for sustainable development and management of biodiversity. They also recognize the need for a coordinated and integrated approach to biodiversity management. The Government of Barbados has also demonstrated its commitment to the sustainable development of natural resources by setting up a National Commission on Sustainable Development which comprises several committees mandated to advise the Government, inter alia, on national policy for sustainable development of natural resources. In the following section the ministries and other agencies with responsibility for biodiversity conservation are presented, in addition to NGOs which play a role in this regard in Barbados.

1.7.1 Governmental Agencies

Ministry of Environment, Energy and Natural Resources: The Ministry of Environment, Energy and Natural Resources, through its various Divisions, has responsibility for all matters pertaining to human and environmental health. These Divisions include the Coastal Zone Management Unit (CZMU), the National Conservation Commission (NCC) and the Energy Division. The current responsibilities of the Ministry include:

- advising the Minister on national environmental policy and legislation, including environmental impact assessment;
- developing and executing environmental education and public awareness programmes;
- advising the Minister on a range of environmental management concerns including the development of protected areas, research and technical assistance needs;
- facilitating the integration of the environmental dimension into the development planning process;
- advising on the adaption of global environmental initiatives to the local context and otherwise articulating local concerns for the international context;

- serving as the technical focal point for a wider range of regional and international environmental programs and institutions.

Some of the institutional constraints which the Ministry faces in regard to carrying out its responsibilities were identified under EMLUP as:

- Inadequate staffing;
- Deficiency in appropriate training, e.g in communication/media skills;
- Unavailability of vital technical support from the Government Information Services (GIS) at most times for environmental programmes;
- Lack of a structured information database or library for technical material;
- Lack of direct financial support;
- Weak political support as the subject area is given little priority/importance.
- Responsibilities of the existing Divisions of the Ministry of Environment, Energy and Natural Resources relevant to the conservation and sustainable use of biodiversity are described in the following sections.

National Conservation Commission **(NCC)**: The NCC is mandated to conserve the natural beauty of Barbados, control and develop public parks, public gardens, beaches, caves and marine underwater parks and regulate commercial activities in public parks, gardens, caves, and on beaches.

The NCC is also involved in cleaning and maintaining these above mentioned public amenities, and employs 125 Park Rangers and Wardens in order to administer activities in the national parks and beaches. There are also some small-scale re-vegetation programs undertaken by the NCC periodically. The NCC essentially plays a vital role in the preservation of biodiversity through regulation of human activities in ecologically sensitive areas. Restricted areas may be established by the NCC and it may, with the approval of the Minister of Lands, make Regulations for the protection of these areas.

The Environmental Special Projects Unit **(ESPU)**: The Environmental Special Projects Unit (ESPU) is a division of the MEE and employs an Executive Officer, a Director, an Architect, an Environmental Engineer and three Administrative staff. The ESPU is responsible for the execution of the ***Barbados Beatification 2000*** project, Assisting in the development of the proposed ***National Park, the Botanical Gardens*** and assistance with the development of work programmes for the ***Caves of Barbados Project.***

The ESPU objectives broadly include:

- The upgrading, diversification and protection of tourism product through the development of sites that can serve as attractions and recreational areas, and providing opportunities for scientific research and the integration of locals/residents into the process;
- Protection of the quality and integrity of ecosystems including, air water, land and animal components;
- Focusing on linkages between humans and ecosystems within the National Park System and throughout the island system as a whole;
- The collection of species for the proposed Botanical Gardens in order to facilitate educational and recreational purposes;
- and the promotion of protection, conservation and wise use of Barbadian flora.

The Coastal Zone Management Unit **(CZMU)**: The CZMU is a government agency specialising in the environmental management of the coastal zone. It carries out routine monitoring and analysis of oceanographic conditions around the island, hydrographic surveys, GIS data management and water quality monitoring. The CZMU also assists in the evaluation of all coastal related development planning applications submitted to the Town and Country Planning Office. This agency can be said to play a vital role in the preservation of marine and near shore biological assets.

Town and Country Planning Department **(TCPD)**: The Town & Country Planning Department, under the Ministry of Finance and Planning, is the primary agency responsible for the planning of land resources in Barbados. The TCPD essentially facilitates the "orderly and progressive" development of land, based on an approved National Physical Development Plan. The National Physical Development Plan is prepared by the Chief Town Planner and approved by the Minister responsible for planning.

The Development Plan refers to provision for a number of matters that include amenities such as: (a) allocation of lands as open spaces; (b) allocation of lands for communal parks, bird and other sanctuaries and protection of marine life; (c) preservation of sites of artistic, architectural, archaeological or historical interest; (d) the preservation or protection of forests, woods, trees, shrubs, plants and flowers; and (e) prohibiting, regulating and controlling the deposit of waste, materials and refuse, the disposal of sewage and the pollution of rivers, lakes, ponds, gullies and the seashore. The Plan also makes provision for facilitating the establishment and operation of public services in relation to, for example, power, water supply, sewerage, drainage, sewage disposal and refuse disposal.

Findings of the EMLUP study have indicated that the TCPD has generally been unable to effectively monitor and regulate development activities, which may be in conflict with the Town and Country Planning Act (TCPA). The TCPA was also found to be inadequate in some respects as a regulatory instrument e.g the regulation of sand mining and quarrying activities. It was also observed that there was a lack of adequate personnel to properly regulate such development or resource extraction activities.

The Ministry of Agriculture and Rural Development: The Ministry of Agriculture and Rural Development has overall responsibility for agricultural development in Barbados. Its function is carried out through two divisions, Livestock and Crop, as well as through several specialized sections, such as the Agricultural Planning Unit, Plant Pathology Unit, Central Agronomic Research Station, Entomology, Land and Water Use Unit, Animal Nutrition Unit, Agricultural Stations, Soil Conservation Unit, and Veterinary Services.

The Fisheries Division: The Fisheries Division falls under the Ministry of Agriculture and Rural Development. This agency engages in fisheries planning and management. The Fisheries Resource Management Section of this Division provides scientific information for planning and implementing measures for fishery management and development, including:

- Catch and effort statistics
- Biological, social and economic information
- Fisheries management measures
- Computer management
- Aquaculture and mariculture
- Library service.

Other Agencies with Relevant Responsibilities

The ***Barbados Agricultural Management Company Ltd.(BAMC)*** was set up by the government of Barbados and given a 12 year lease to manage sugarcane farms and factories which had become indebted to the banks. BAMC also operates the Agronomy Research and Variety Testing Unit (ARVTU) which is geared towards the improvement of sugarcane cultivars and sugar yields and the reduction of production costs.

The ***West Indies Central Sugar Cane Breeding Station (CBS)*** located at Groves in St George, is operated by the Sugar Association of the Caribbean and is responsible for the production of seeds each year for distribution to participating variety testing stations such as the ARVTU. The CBS maintains 16 ha of land, a working collection of over 1000 commercial clones and 900 species and early-generation interspecific hybrids.

The ***Caribbean Agricultural Development Institute (CARDI)*** sub-regional office located on the Cave Hill Campus of the University of the West Indies conducts research on animal production and

development, and crop production and development. CARDI also provides technical assistance to farmers and government agencies.

The office of the ***Director of Public Prosecutions (DPP)*** is responsible for the enforcement of environmental regulations and legislation and the prosecution of violators of these laws. The DPP office was found in the EMLUP Report to posses inadequate resources, and so lacks the strength to prosecute violators of environmental conservation regulations. Increased staffing is required to overcome most of the difficulties presently being experienced by the DPP.

1.7.2 Non-governmental Organizations

The ***Bellairs Research Institute*** was established as a marine research facility in Barbados in 1954. It is affiliated with McGill University in the city of Montreal, Canada. Bellairs goal is to provide scientists with high quality tropical laboratory and field facilities in the Caribbean.

The ***Caribbean Planning for Adaption to Global Climate Change (CPACC)*** Project is funded by the Global Environment Facility (GEF), through the World Bank and coordinated by the Organisation of American States. The project is being implemented in the Caribbean by the Regional Project Implementation Unit (RPIU), which was established by the UWI Centre for Environment and Development (UWICED). A Policy Advisory Committee, chaired by CARICOM, provides overall guidance for implementation of activities.

The project's overall objective is to support Caribbean countries in preparing to cope with the adverse effects of global climate change (GCC), particularly sea level rise in coastal and marine areas, through vulnerability assessment, adaptation planning, and capacity building linked to adaptation planning.

The Faculty of Science and Technology of the ***University of the West Indies (UWI)*** Cave Hill Campus is situated in Barbados, and offers a Bachelor of Science degree in Biology. This programme prepares students for entrance into fields related to the conservation of biological diversity. Some of the relevant courses offered include Biodiversity, Genetics, Biological Experimentation, Population Ecology, Community Ecology, Crop Ecology, Human Ecology and Conservation, Animal Physiology, Plant Physiology, Microbiology, Molecular Biology, Marine Biology and Fisheries Biology.

The Natural Resource Management Programme (NRMP), formerly the Marine Resources and Environmental Management Programme (MAREMP), a department of the Centre for Resources Management and Environmental Studies (CERMES) at the UWI, Cave Hill, aims to promote enhanced management of the marine environment and marine resources. The NRMP curriculum facilitates postgraduate training in resource and environmental management that strengthens the capability of the UWI in providing advisory and consulting services in marine resources and environmental management. It also supplements efforts of faculty members at the UWI, to develop

applied research programmes in marine sciences and management. The programme provides a general background in resource and environmental management with a specialisation in either Coastal Zone Management or Fisheries Management. The NRMP has potential to play a significant role in biodiversity conservation efforts in Barbados.

The Caribbean Conservation Association (CCA) is a non-governmental organization which has for over twenty nine years focused on the conservation, protection and wise use of the region's natural and cultural resources. CCA is based in Barbados and is managed by a Board of Directors, elected by the membership for a two year term. The day to day activities are co-ordinated by the Executive Director and implemented by a small core of professional and administrative staff. Active working groups drawn principally from the membership assist in the definition of priorities, in the formulation of programme and policy elements, the preparation of project proposals and their eventual implementation. CCA's programmes are regional in scope and covers issues relating to Cultural Heritage, Environmental Education, Information Management, and Sustainable Resource Management.

The ***Caribbean Alliance for Sustainable Tourism (CAST)***, has been actively promoting sustainable tourism activities, and providing technical support within the hotel and tourism sector in Barbados as well as the greater Caribbean region. CAST has been instrumental in the establishment of a system of internationally accepted ISO 14001 environmental standards for some of the participating hotel and tourism establishments.

The hotel sub-sector in Barbados has been doing its part in conserving biodiversity. A few hotels have adopted reefs located near to their establishments and are trying to keep them clean and protected from intentional or unintentional damage from anchorages by boats and trampling by divers and snorkellers. Some have even gone as far as to sponsor local diving groups in clean up programmes in an effort to promote awareness among users. Generally, beachfront hotels now actively liaise with conservation groups such as the Barbados Sea Turtle Project (the implementing organisation of WIDECAST in Barbados), via the University of the West Indies. The monitoring of sea turtles' nesting and hatchling activities are routinely carried out by this organization, as well as the active promotion of the conservation of sea turtles and their habitats.

2. NATIONAL VISION FOR CONSERVATION OF BIODIVERSITY

The national vision for conservation and sustainable use of biodiversity in Barbados is enshrined in a set of principles which guide the thinking and provide the basis on which many of the programmes will be developed. These principles have been fashioned on the basis of collective views of a wide cross section of stakeholders who participated in several roundtable discussions as well as a National

Consultation on Biodiversity. These principles are founded on a common view that the resource base is fragile and must be conserved and used in a sustainable manner to ensure that both present and future generations will continue to benefit from the diverse contributions which these resources provide to human and other life forms. In embracing these principles and ensuring that they will be adhered to, some clear objectives needed to be defined and action plan outlined which manifested the expressed commitment of the people and government of Barbados.

2.1 Vision

The NBSAP study was intended to provide the basis for guiding the conservation of biodiversity in Barbados. If the priorities and actions identified in the NBSAP are to be realised then conservation of biodiversity needs to become an integral part of the national development process in Barbados. The following set of specific goals have been outlined which are aimed at addressing the threats to biodiversity as well as prescribing the means whereby conservation and sustainable use can be pursued. These goals are critical in having an effective strategy and action plan and may be summarised as follows:

- **Sustainable Development**

Barbados will become a model of sustainable development among Small Island Developing States (SIDS). Integral to this, will be the development of sustainable ways of living and producing for all sectors of society (present and future), which are founded on the sustainable use and management of biodiversity.

- **Environmental Preservation**

Barbados will be a nation that appreciates the intrinsic value of its natural assets, including ecosystems, landscapes and species. Respect for nature and responsibility for its protection will become an important part of the Barbadian consciousness.

- **Responsible Economic Decision-Making**

The Government and people of Barbados will recognize the critical role that biological resources play in the generation of economic benefits for the country and will endeavour to make environmental considerations, including biodiversity conservation, an integral part of national economic decision making.

- **Protection of National Biological Heritage**

Barbados will recognize its biodiversity as part of its national heritage and accord it a high conservation priority.

2.2 Specific Goals & objectives for Biodiversity Conservation

The NBSAP component of the *MEE Biodiversity Work Programme* (as defined in ES 1.1) also sought to define the current status of biodiversity, the threats leading to its degradation and the strategies and priority actions to ensure its conservation and sustainable use within the framework of the socio-economic development of Barbados.

In this context, the specific objectives guiding the development of the NBSAP and which are based on the National vision are as follows:

- identification of the current state of knowledge about biodiversity in Barbados;
- assessment of resources, identification of important gaps in the knowledge base and the assessment of further needs and associated costs;
- identification of current pressures on biodiversity;
- assessment of the present and future value to Barbadians of the country's biodiversity;
- assessment of the costs and benefits of conserving biodiversity in Barbados;
- identification of the conservation priorities and strategies for conserving biodiversity and projection of future trends;
- identification of Conventions subscribed to, relevant legislation, and gaps in existing legislation;
- identification of relevant institutions, and the institutional requirements to support the implementation of the strategies and actions; and
- identification of appropriate mechanisms or actions to carry out the identified conservation strategies.

The purpose of the Action Plan was to identify specific mechanisms by which the strategies will be implemented to achieve the stated goals and objectives. It is anticipated that these actions will be adopted by the various implementing agencies.

2.3 National Biodiversity Conservation Programmes & Initiatives

Within the last decade or so, a number of initiatives have been undertaken and plans developed to meet the needs of the present population, without creating an imbalance between man and the natural environment which will adversely affect the ability of future generations of Barbadians to meet their own needs.

The NBSAP was envisaged to complement other plans relevant to national sustainable development planning, which have already been prepared and implemented or which are in the process of being prepared. They include the following:

- The ***Physical Development Plan (PDP)***, revised in 1998, provides policies for the use of land and the criteria and controls over the types of development which are allowable in different parts of the island.

- The ***Fisheries Management Plan (FMP)***, completed in 1997, contains the schemes for the management and development of fisheries in the territorial waters of Barbados as required by law under the Fisheries Act (1993-6). The FMP contains eight fishery-specific plans which are intended to ensure the sustainable use of the Barbados' fisheries resources for the benefit of the people of Barbados.

- The ***Environmental Management and Natural Resources Management Plan***, prepared in 1998 as part of the Environmental Management and Land Use Planning for Sustainable Development Project (EMLUP), provides the framework and policies within which the government could protect, regulate the use, and monitor the health of the island's environment and natural resources. This Plan has not yet been adopted by the Government of Barbados.

- The ***National Park Plan (EMLUP, 1998)***, and the ***Coastal Zone Management Plan (Halcrow, 1998)*** recognizes the importance of the National Park Area and the coastal area of Barbados, respectively, to the conservation and economic development of the island. The National Park Plan will be augmented by two local area plans under development for the Folkestone Marine Reserve at Holetown, St. James and for a proposed reserve in Carlisle Bay. The National Park Plan also provides direction for the preparation of management plans for the Natural Heritage Conservation Areas.

The existing plans and those in process provide a suitable framework 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. A NBSAP which provides for the integration of biodiversity management and conservation into these sector plans would serve to minimise overlap and increase efficiency of use of human, financial and equipment resources. In order to achieve this successfully, there must be an improvement in inter-agency collaboration and coordination of environmental and natural resources planning and management activities.

Ongoing Programmes currently being undertaken by the MEE include:

The ***Sustainable Development Programme***; The main objective of the programme is to inform all persons in Barbados about the principles of sustainable development with the view towards encouraging them to adopt habits and attitudes in harmony with these principles. The programme involves:

(1) The formulation of National Policy on Sustainable development;
(2) The creation of a National Commission on Sustainable Development; and
(3) The coordination of International Sustainable Development Policy.

The ***Beautify Barbados 2000 Project*** is also currently being undertaken by MEE and executed by the ESPU of this ministry. This project is concerned with the overall beautification of Barbados, as well as to increase the vegetative cover, in order to mitigate against the adverse effects desertification, which has lead to increased land degradation over time. Activities being undertaken in order to achieve this objective include:

- Encouraging individuals, businesses and community participation in the beautification of their communities;
- Reduction and elimination of littering and illegal dumping;
- Educating the public about the importance of plants and how they can be used to enhance residential, commercial and industrial areas;
- Stimulating the production and use of indigenous and naturalized plants;
- Exposing the public to new techniques in landscape design, including water conservation and zero scaping, i.e the use of drought tolerant plants;
- Developing a concept of maintenance of open spaces rather than debusing;
- Involvement as individuals and as communities in the greening of Barbados;
- Planting trees and flowering plants in neighborhoods etc;
- and Soliciting the active participation of youth groups and schools.

The ***Gully Rehabilitation Programme*** is being undertaken by MEE. The goal of the current programme is to develop a strategic Environmental Management Framework and Programme for the rehabilitation of gully ecosystems throughout the island.

The activities of the programme are:

(1) To prepare a comprehensive integrated management strategy and programme for the national gully system which recognizes the following key issues:

   (1) preservation and enhancement of biodiversity resources,
   (2) maintenance of storm water flow patterns, including the protection of critical groundwater catchment areas and abstraction zones, and
   (3) identification of sustainable socio-economic uses of selected gully systems.

(2) The development and implementation of public awareness and education programmes in order to compliment the initiatives of the programme.

2.4 Funding of the Biodiversity Work Programme

The annual budget available for undertaking the *MEE Biodiversity Work Programme* initiatives in Barbados are very limited and are allocated over a number of policy areas including public relations. Additional funding for projects is obtained from the Convention Secretariat (MEE, 2000). The biodiversity work programme initiatives have been funded by the United Nations Environment Programme (UNEP) through the Global Environment Facility (GEF) project to date.

3. THE BIODIVERSITY CONSERVATION STRATEGY

The following prerequisites underpin the guiding principles for conservation and the sustainable use of biodiversity in Barbados, and are intended to facilitate the smooth and successful implementation of the NBSAP. These prerequisites primarily concern changes that must take place in the ways in which biodiversity is viewed by the public and private sectors, and in the manner in which the strategy and action plan as outlined below are pursued.

Establishment of a National Policy and Legislative Framework Supportive of Biodiversity Conservation

Though the conservation or loss of biodiversity occurs primarily at the local level, Government policies regarding agricultural production, urban development, industrial growth, natural resources management, tourism development and environmental protection creates the incentives that facilitate or constrain local action. If these policies do not place a high enough value on environmental resources, they will hasten the loss of the island's biodiversity. The biodiversity conservation planning process in Barbados must therefore include the reform of policies that promote the damaging expansion of urbanisation into natural habitats, the over-exploitation of marine fisheries, the excessive use of monoculture production, the excessive use of agrochemicals, the degradation of aquatic, coastal and marine ecosystems, and any other policies that contributes to the loss of biodiversity. New policies that promote conservation and the equitable use of biodiversity should be adopted instead, and, in conjunction with the strengthening of the national policy and legislative framework. The capacity of institutions which undertake activities relevant to biodiversity conservation must also be strengthened through improved training of staff and improved access to the financial resources required to carry out their functions.

Integration of Biodiversity Conservation with National Sustainable Development Planning Efforts

Biodiversity and biological resources are fundamental to the country's development process. Though a separate biodiversity conservation planning process is valuable in identifying what exists and what conservation priorities for biological resources should be, it is important that the biodiversity conservation planning process be integrated with wider sustainable development initiatives in the country. The integration of biodiversity conservation as far as possible into other sectoral planning initiatives is in fact required under *Article 6, Section b* of the CBD. Ultimately, the aim would be to integrate biodiversity planning into existing

plans, strategies and programmes aimed at sustainable development and to make these more efficient by reducing overlap and redundancy. When this occurs, the strengthening of human resource capacity and conservation tools, along with the mobilisation of the benefits of biodiversity, will be institutionalised and self-perpetuating. Appreciation by the Government of biodiversity's contribution to national development and human needs, should be reflected in policies, which directly or indirectly encourage biodiversity conservation. For example, policies which emphasise investment into scientific research, including taxonomic research and research into plant cultivation techniques should be developed along with the improvement in the capacity for cross-sectoral action.

Making Public Awareness and Public Participation an Integral Part of the Process

An important aspect of achieving the desired level of biodiversity conservation is expanding people's awareness of the importance of biodiversity and appreciation of its significance. Conservation efforts will only be successful if persons in all sections of society understand the distribution and value of biodiversity, how it affects their everyday lives and how to use it to meet their needs without causing degradation.

The biodiversity conservation planning process should also be as participatory as possible. All stakeholders in the process should be afforded the opportunity to share responsibility for developing the strategy and action plan and to jointly implement the plan. Stakeholder participants are those who have the responsibility for, depend on for their income, live within or otherwise care for, the variety of life and living resources. These persons should possess the knowledge, values and technologies required for successful implementation of biodiversity conservation actions. In addition, persons who participate in the decision-making about what needs to be done and how, are more likely to understand the purpose of the actions and to be committed to following through with their implementation. Stakeholder participation has been an integral part of the process of identifying biodiversity conservation priorities, strategies and actions for Barbados.

Development of Human Resource Capacity to Manage and Conserve Biodiversity

Achieving the desired level of biodiversity conservation also necessitates the building of human capacity to manage and conserve biodiversity at all levels of society, for example, policy-makers, scientists, activists, resource managers, educators, school children, householders, etc. Research must be explicitly linked to national resource and development needs and findings must, in turn, be accessible and understandable to decision-makers.

Development of a Supportive Macroeconomic Environment for Biodiversity Conservation

Macroeconomic policies strongly influence the way in which biological resources are used and the level of emphasis that is placed on their conservation. For example, macroeconomic policies that emphasise tourism investment encourage the acquisition of land in coastal areas for the construction of tourism facilities. This may result in the degradation of coastal ecosystems and the species that inhabit them. These policies may also indirectly encourage the conversion of agricultural lands in more rural areas to residential development because of higher land prices in the already more developed areas of the country. While biodiversity conservation does not mean an end to development, it does require changes in the macroeconomic environment to encourage the use of environmental economics analytical tools in identifying the instruments essential to the preservation of sensitive environments and important habitat areas.

3.1 Requirements For The Implementation of Biodiversity Conservation Actions

The successful implementation of the biodiversity strategy and action plan is ultimately dependent on the interest and will of all Barbadians. At the national level, the political directorate will need to confirm that it has indeed recognised and fully accepted the importance of biodiversity as an integral part of a sustainable development plan for Barbados. Decision makers, will therefore be required to give their full support to the development and articulation of policies and supportive instruments such as the required legislative and regulatory provisions, to ensure the implementation of the national biodiversity strategy and action plan. In addition, the various entities, governmental and non governmental, will have to ensure that their programmes and other activities designed to achieve the goals of conservation and sustainable use are being implemented and enforced. However, a prerequisite for such a coordinated approach is that the management mechanisms, as reflected in the institutional and legislative regimes must be established.

Institutional strengthening for biodiversity management can be achieved through:

- establishment of a unit or committee responsible for coordinating biodiversity management and protection efforts;
- define distinct mandates for the relevant institutions with respect to the conservation of biodiversity;
- appropriation of suitably trained human resources among these institutions;
- improvement of communication between the various institutions involved on biodiversity conservation issues and activities;
- efficient dissemination of biodiversity related information by relevant government agencies to increase the level of awareness of the general public of biodiversity

conservation, and also to strengthen the political will of the GOB to protect biodiversity.

The NBSAP Country Study and the Public Consultation process identified the following areas, which would greatly enhance the GOB's capacity to undertake effective conservation and management of the island's biodiversity:

- Establishment of Protected Areas;
- Revision and updating of legislation and regulations for the protection of habitats and species;
- On-going research and compilation of biodiversity information into a central repository, including the collation and maintenance of a comprehensive GIS database;
- Expansion of the capacity to provide biodiversity and related environmental education and public awareness to the citizens of Barbados;
- Enhancement of the capacity to effectively prosecute violators of existing regulations put in place to ensure the protection of biodiversity.

At the technical level, there needs to be an increase in the cadre of professionals who can provide accurate information and advice to the decision making process. At the macro level this information will allow policies and major development decisions to be made with concern for biodiversity issues.

At the micro level, where the day to day lifestyle decisions of the average citizens can negatively impact on biodiversity, it is critical that this information be simplified and made available through accessible channels.

Finally, at the local and community levels, the NGOs, Community-based Organizations (CBOs) and private agencies, including developers, banks etc., must become committed to increasing their knowledge of how their work impacts on the environment. They must begin to operate in ways which will enhance the environment and provide leadership by example. At the individual level, every citizen must be committed to a healthy and safe Barbados, and to becoming stewards of the environment. Public awareness programmes must be developed and implemented to complement and ensure that respect, and appreciation for the country's natural biological diversity is instilled for a truly sustainable conservation effort.

3.2. Schedule for Implementation of the Biodiversity Action Plan

Essential to the success of the Biodiversity Strategy and Action Plan is the identification of priorities and time frames for their achievement. Not all of the strategies and actions identified in the previous section contribute equally to ensuring the protection of Barbados' biodiversity, neither do they have the same degree of urgency. In addition, some of the actions will be pursued as part of other sectoral plans, such as those described in section 1.6.1 of this document. There are also strategies and actions which will be undertaken by various non-governmental organisations and individuals as part of their ongoing efforts to protect the environmental resource base in Barbados without substantial financial contribution from the Government of Barbados.

This section attempts to identify those strategies and actions which are of the highest priority for the conservation of biodiversity in Barbados. These conservation priorities will form the foundation for the establishment of a biodiversity conservation ethic in the planning processes of Barbados and for the implementation of the various initiatives identified in "***The Biodiversity Strategy and Action Plan***".

Table 3.1 presents the priority actions, the time frames for their implementation, the associated costs for undertaking implementation, and the key implementing institutions and agencies. Relevant government agencies are expected to make in-kind contributions in terms of institutional support within their respective areas of competence/responsibility.

The key below provides explanation of terms used in the table.

KEY:

Priority actions : Those actions or activities identified in the Strategy and Action Plan which will form the basis of biodiversity conservation efforts in Barbados. These actions need to be addressed and reviewed within a three year period prior (using available technical and financial resources) prior to the implementation of further initiatives.

Level of priority : The degree of urgency with which actions must be implemented to ensure the conservation and sustainable use of biodiversity.

H : *Very urgent.* Essential to the prevention of further loss of biodiversity.

M : *Moderately urgent.* Necessary to the conservation of species and habitats over the short term.

L : *Slightly urgent.* Needs to be implemented to ensure sustainable use of biodiversity over the long term.

Time frame for implementation: Period of time within which action should be implemented and specific targets achieved.

Table 3.1 **Recommended Schedules & Budgets for Implementation of Priority Actions & Activities (NBSAP, 1999)**

GOALS & OBJECTIVES	PRIORITY TASKS & ACTIVITIES	LEVEL OF PRIORITY			TIME FRAME FOR IMPLEMEN-TATION	COST BREAKDOWN $BDS.	KEY IMPLEMENTING INSTITUTIONS & AGENCIES (PARTNERS)
		H	M	L			
1.Conservation and sustainable utilisation of biodiversity.	Develop a national policy on the conservation and sustainable use of terrestrial and marine biodiversity.	–			Within 1 year	In-kind Contribution	MEE, DPP
	Establish a representative system of protected areas for significant biodiversity areas. In addition, undertake mapping and an analysis of the public and private ownership patterns within these areas.	–			Within 3 years	In-kind Contribution + $150,000 (Consultancy Fees , Equipment Procurement)	MEE, TCPD; Dept of Lands & Surveys;
	Use suitable economic valuation methods to value the island's biodiversity so that these values can be included in the national accounting system.			–	Within 3 years	$30,000 (Consultancy Fees)	UWI
	Strengthen the legislative framework for the protection of biodiversity and critical or vulnerable habitats, including mechanisms for enforcement of existing legislation.	–			Within 1 year	In-kind Contribution	MEE, DPP, UWI
	Strengthen institutional capacity to manage and conserve biodiversity.				Within 2 years	$350,000 (Staff training,/Recruitment, Equipment procurement)	MEE.

GOALS & OBJECTIVES	PRIORITY TASKS & ACTIVITIES	LEVEL OF PRIORITY			TIME FRAME FOR IMPLEMEN-TATION	COST BREAKDOWN $BDS.	KEY IMPLEMENTING INSTITUTIONS & AGENCIES (PARTNERS)
		H	M	L			
2. Improved public awareness and education on biodiversity issues.	Disseminate information on biodiversity to primary and secondary schools through essay competitions, poster competitions, etc. and incorporate biodiversity issues into the school curriculum.		–		Within 3 years	In-Kind Contribution + $25,000/year (Published materials, media promotion etc.)	MEE, Min Of Education, Government Information Service, UWI.
	Promote and provide scholarships and exchange opportunities for tertiary level studies in terrestrial ecology.		–		Within 3 years	In-kind contributions + $120,000 /year (Scholarship funding)	MEE, Min of Education, UWI
	Present seminars at hotels to increase the awareness of visitors of the special challenges of tourism on small island natural and socio-cultural environments and of the part that they can play in ensuring that natural and cultural resources are used sustainably.		–		Within 1 year	In-kind contributions + $5,000 (published materials)	MEE, The Hotel & Tourism Industry
	Create awareness among the judiciary via workshops about existing penalties for habitat damage and about the importance of enforcing these penalties to offenders.	–			Within 1 year	In-kind contributions	MEE, DPP
3. Fair and equitable sharing of benefits arising out of the use of biodiversity.	Set up a Commission on marine and terrestrial Genetic Resources.	–			Within 1 year	In-kind contributions	MARD, UWI, CARDI, Barbados Agricultural Society, West Indies Sugar Cane Breeding Station
	Develop a national planting material	–			Within 3 years	In-kind contributions	

GOALS & OBJECTIVES	PRIORITY TASKS & ACTIVITIES	LEVEL OF PRIORITY			TIME FRAME FOR IMPLEMEN-TATION	COST BREAKDOWN $BDS.	KEY IMPLEMENTING INSTITUTIONS & AGENCIES (PARTNERS)
		H	M	L			
	programme to include awareness, certification and standards for seed exchange						
4. Improved biodiversity research and data storage.	List and compile information on indigenous, rare and threatened species and communities and develop management plans for their protection. Information required includes life history and habitat linkages, distribution, abundance, diet, and reproductive behaviour. Updating and expanding the herbarium facility at UWI.	–			Within 3 years	In-kind Contributions + $350,000 (Research grant funding, Consulting fees, Database development and maintenance, Staff training, Equipment procurement)	MEE, CZMU, Fisheries Division, UWI,
5. An ongoing programme of monitoring of species conservation.	Establish a national programme of on-going monitoring to document the status and patterns of change of species in terrestrial, marine and aquatic ecosystems.	–			Within 1 year	In-kind Contributions	MEE, CZMU, Fisheries Division, UWI.
6. Improved access to adequate financing for the management and conservation of biodiversity.	Proactively participate in international arrangements and organisations of financial benefit to Barbados through the effective marketing of the island's national biodiversity strategy. Conduct comprehensive environmental economic evaluations to quantify the	–			Within 3 years Within 2 years	In-kind Contributions In-kind Contributions + $20,000 (Consulting fees)	MEE, Min of foreign Affairs, Min of Tourism. MEE, UWI.

GOALS & OBJECTIVES	PRIORITY TASKS & ACTIVITIES	LEVEL OF PRIORITY			TIME FRAME FOR IMPLEMEN-TATION	COST BREAKDOWN $BDS.	KEY IMPLEMENTING INSTITUTIONS & AGENCIES (PARTNERS)
		H	M	L			
	direct and indirect value of all components of biodiversity. Develop innovative incentives to promote conservation and sustainable use of biodiversity by all stakeholders.				Within 3 years	In-kind Contributions	MEE, UWI.
7. Reduction of biodiversity loss through overexploitation caused by poverty.	Undertake research to determine the effects of poverty on biodiversity in Barbados			–	Within 2 years	In-kind Contributions + 20,000 (Consulting fees)	MEE, Min of Finance, MARD, UWI.

3.3 Monitoring & Evaluation

The MEE is the principal executing agency responsible for coordinating and monitoring the overall implementation of the NBSAP project and the *Biodiversity Work Programme*. Information collected throughout the assessment and strategy phases should be used actively to inform decisions on conservation and management, and to provide a scientific basis for actions. For instance, knowledge of land cover conditions and land use changes is an important prerequisite to conservation plans. An effective monitoring system, to provide this kind of detailed information about the environment and the results of policies and actions, should have the following indicators:

- status and trends of Barbados' use of terrestrial, aquatic coastal, and marine resources, habitats, species, populations, biodiversity services, and threats to biodiversity;
- shifts in selected social, political, and economic factors in Barbados;
- shifts in human, institutional, facility, funding capacity, including cultural practices and norms, technology, training and education, information availability, management, and monitoring capacity in Barbados;
- changes in policy and legal framework for natural resources, including protected areas, access to genetic resources, land tenure, property rights, benefit and cost sharing, trade and environmental impact assessment;
- changes in the use of biological resources and their sustainability, including natural-resource-based industries, and exploitation of resources for subsistence;
- trends in the monetary and non-monetary values of biodiversity and current expenditures and investments; and
- impacts of implementing the activities and policies of biodiversity plan(s), vis-a-vis conservation, sustainability, and equity in Barbados.

Monitoring, supervision and general technical assistance is carried out by other relevant ministries charged with biodiversity management/conservation responsibilities, and consultants contracted to facilitate aspects of the NBSAP's implementation. The information requirements for monitoring the implementation of the NBSAP project activities are as follows:

- Identification of activities that are underway
- Clear statements of progress being made (e.g quarterly reviews)
- Costs incurred in relation to the progress of implementation (e.g. monthly statements)

- Assessment of results to determine if they satisfy the quality criteria (e.g. quarterly update)

- Assessment to determine if the results enhance the project purpose (e.g. half-yearly analysis)

- Assessment of the impact of the project on the status of biodiversity (e.g. interim evaluations carried out once the project is underway - at the end of specific phases of the project, on completion of the project, and a number of years after completion).

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