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List of Abbreviations

ADP	Area Development Plan
BAMC	Barbados Agricultural Marketing Cooperation
BWA	Barbados Water Authority
CAPE	Children's Association for the Protection of the Environment
CARICOM	Caribbean Community
CBD	Convention on Biological Diversity
EED	Environmental Education Division
EMLUP	Environment Management and Land Use Planning
ENRMP	Environment and National Resources Management Plan
FAO	Food and Agriculture Organisation
GIS	Geographic Information Systems
MEE	Ministry of the Environment, Energy and Natural Resources
NAP	National Action Plan
NCB	National Coordination Body
NFP	National Focal Point
NGO	Non Governmental Organisation
PDP	Physical Development Plan
PPC	Planning and Priorities Committee
SCADA	Supervisory Control and Data Acquisition System
SCU	Soil Conservation Unit
UNCCD	United Nations Convention to Combat Desertification and Drought
UNDP	United Nations Development Programme
WRM&WLS	Water Resources and Water Loss Study

Executive Summary

On May 14, 1997, Barbados signed the United Nations Convention to Combat Desertification and Drought. The Convention came into force for Barbados on 14 August 1997.

This Convention is very important to Barbados for two reasons:

1. The island experiences extreme cases of soil erosion in the Scotland District area
2. The island is considered to be a water scarce country by the United Nations Development Programme (UNDP) and the Food and Agriculture Organisation (FAO)

All measures which Barbados currently has in place to combat desertification and drought were all developed prior to Barbados' involvement with the UNCCD. Barbados is now in the process of preparing its' National Action Plan in accordance with UNCCD principles.

ES 1. Strategies Established Within the Framework of Sustainable Development Plans and/or Policies

The Government of Barbados has put in place policies and programmes aimed at achieving sustainable development in accordance with the principles of Agenda 21.

In Barbados, the issue of desertification is addressed through policies on land resources. A synopsis of the relevant plans and polices pertaining to this area are given below.

Draft National Physical Development Plan (1998)

This document is intended to provide a vision for the future growth and development of the Nation by setting out policies to guide relationships among land uses, community facilities and physical infrastructure.

Area Development Plan

The ADP is a project undertaken by the Town & Country Development Planning Office which examines agriculture and non-agricultural land classes, as well as the future land use policies affecting agricultural land.

The National Park Development Plan 1998 (Final Draft)

This plan seeks to promote land management within the designated park boundaries in such a way that the biodiversity of the various ecological systems are preserved and enhanced for the benefit and enjoyment of the Barbadian society. The Scotland District, an area which experiences severe land degradation, is encompassed in this plan.

The Environment and Natural Resources Management Plan (1998)

This plan seeks to address the issue of sound use and development of all natural resources in the island in a manner that is harmonious with the natural ecosystems.

The Medium Term Macro-Economic Strategy (1996-1999)

Development policies enunciated in this document establish the Government of Barbados' intentions and expectations for each sector of the economy over the medium and long term.

Integrated Coastal Zone Management Plan (1998)

This plan addresses issues regarding land use and resource use in the agricultural sector. Run-off containing substances originating from the misuse of pesticides from agricultural production, contaminate water supplies and affect marine life.

Barbados Tourism Development Plan (1998)

The Tourism Development Programme sets out the framework for development of an integrated rural land use policy bringing greater tourism access and sustainable development to rural areas, such as the Scotland District.

National Tourism Policy

The National Tourism Policy addresses the issues of land degradation and water conservation as these resources are vital to the prosperity of the industry. The broad policy objective of this sector incorporates sustainable development principles through conservation of natural resources.

National Water Conservation Plan

The National Water Conservation Plan is currently undergoing its implementation phase. The measures adopted have been developed to attempt to maximise voluntary reductions, before moving to penalising measures, pressure reductions and system shutdown.

Desalination

There has been a steady increase in water consumption levels which can be attributed to growth in the economy and increased living standards. Facing the prospects of insufficient water to satisfy the Barbadian population, the Board of Directors of the Barbados Water Authority contracted a consultant in August 1995 to examine the feasibility of establishing a desalination facility in Barbados.

In August 1997, PPC examined a submission on a “Framework for the Development and Management of the Water Resources of Barbados” and accepted among other things, the recommendation that desalination was a viable option for augmentation of the BWA’s potable water supply.

The principal constraints hindering Barbados from achieving a sustainable water supply for the next twenty years were identified as:

1. A lack of consistent and appropriate data upon which management decisions can be made; and
2. A lack of technically qualified personnel capable of interpreting that data and implementing the appropriate responses

The Emergency Drought Plan

This Plan identifies parameters, such as rainfall measurements, ground water measurements, salinity and weather data, that would be used to monitor and forecast and give the impact of drought. The Emergency Drought Plan seeks to define the conditions under which a drought-induced water supply emergency exists and to specify the actions that are to be taken in response.

Legislation Review

The pieces of legislation of direct relevance to desertification include the Cultivation of Trees Act (1951), the Trees Preservation Act (1981) and the Soil Conservation (Scotland District) Act (1959). Previous studies on environmental legislation have all concluded that a more cohesive link needs to be made between the legislation as matters relating to similar issues are addressed over a number of statute areas.

ES 2. Institutional measures taken to Implement the Convention

To facilitate implementation of the UNCCD, Barbados appointed a National Focal Point and established a National Coordination Body. The Ministry of the Environment, Energy and Natural Resources was appointed as the National Focal Point and a Committee comprising members from various agencies closely associated with the issues of desertification and drought was convened by the Ministry and forms the National Coordination Body.

National Coordinating Body

The NCB acts as an advisory body and has the mandate to provide potential solutions to the problem 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, thus empowering users towards management.

Financial resources allocated to desertification in the Ministry of the Environment are made available from the biodiversity budget. In 2000, the allocated amount is 1/10 of the allocation for biodiversity under which the programme for desertification falls. The Ministry's budget for biodiversity ranges from BDS\$12,000 to BDS\$18,000 or US\$6,000 to US\$ 9, 000 annually. These funds are used for policy related issues and public awareness. Infrastructural work falls under the Ministry of Agriculture. In the 1997- 1998 budget, actual expenditure for structures was BDS\$702, 145 (US\$351, 072) and in 1998-1999 it was BDS\$840, 601 (US\$420, 300).

A work programme is currently being prepared to facilitate a more coordinated approach to the work of the NCB. The NCB currently does not have any databases of its own.

No specific national strategy or policy exists for strengthening national institutions and administrative capacity to ensure compliance with environmental laws and standards. However, under the EMLUP Study, recommendations were made to improve the environmental institutions, however due to lack of funds or human resources these recommendations can not be implemented.

ES 3. Consultation Process to Formulate the National Action Plan

Consultation with relevant stakeholders are held in order to facilitate the participatory approach to dealing with desertification and drought problems in Barbados. Further consultations are planned to assist in the preparation of the National Action Plan. One such consultation has already taken place in the form of a National Workshop. The UNCCD Secretariat funded this workshop. The National Workshop identified three areas that were seen as requiring Action Plans and it is in these areas that the National Action Plan will focus. They are:

1. Agriculture

The relevant agencies represented at the workshop had the vision that agriculture remain a vital part of the development of the Scotland District, thus contributing towards the reduction in loss of topsoil and the prevention of land degradation. Economic activity through agriculture should be promoted so as to benefit the locals in the area.

2. Settlement

The management of settlement and associated activities as they relate to land degradation within the Scotland District needs to be addressed. The specific objectives of which would be to improve management of existing settlements, combating degradation associated with settlements and rationalising and planning for present and future settlements.

3. Resource Use and Conservation

Conservation and appropriate use of water, arable land, sand, clay, oil, flora and fauna and people is the vision for this area.

The aim is to utilise an integrated information approach based on the available body of knowledge in conjunction with consultation with stakeholders, for use in an integrated management system.

ES 4 Participatory Approach to Combating Desertification and Drought

In Barbados, much emphasis is being placed on public awareness and communication by the various sectors involved in the issues of desertification and drought.

In 1997, the National Conservation Commission agreed that a more co-ordinated approach should be taken regarding the planting and maintenance of trees. In an effort to increase forestation on the island, a committee was established to formulate plans on how best to involve and encourage the local people in the island wide planting of trees. The objectives of the Committee were:-

- I. To establish a national day for tree planting
- II. To sensitise the general public about the importance of trees
- III. To encourage community groups and schools to assist in the preservation of the environment
- IV. To establish an education programme for schools
- V. Reforestation

Water Conservation Programmes

The BWA is involved in public education programmes as they see it as an important part of any conservation programme. These programmes should be on-going but really only take effect during the drought.

Coastal Conservation Programme

The community surrounding Barclay's Park in St. Andrew were the main participants in this effort. The project was implemented between April 1998 and March 1999. The demonstration project focused on practical solutions to the threat of dune instability.

The purpose of the project was to establish a framework for a working partnership among business enterprise, the community, NGOs and Government for sustainable use and protection of dune systems in the island, and to put this partnership to work on practical activities.

Soil Conservation Programmes

The Soil Conservation Unit is based in the Scotland District and is the main government department responsible for this area. The SCU is involved in education of farmers with respect to encouraging sustainable farming practices. These practices include teaching them to keep the soil covered, incorporation of organic matter to assist in percolation, encouraging reduction in the use of fertilisers and incorporation of the principles of Integrated Pest Management into their practices.

ES 5. Financial Resources Allocated to Combatting Desertification and Drought

Currently any monies needed are obtained from the biodiversity budget. Some monies were allocated in 1999/2000 for public awareness activities and low cost community projects. Any other projects undertaken, were funded by monies obtained from the Convention Secretariat. For the financial year 2000/2001, funds are allocated for public awareness from the biodiversity budget, however it is foreseen that these will not be adequate to fully allow for the development of a comprehensive plan for implementation. Biodiversity has a total budget of BDS\$18000 (US\$9000)

which has to be split among ten sub areas of which CCD is one. No money has been allocated to formulate the NAP, as this will be undertaken by the committee.

In addition to needing funding, Barbados is also lacking in some areas and requires more technical expertise. In general, personnel currently employed have experience in their various subject areas but require training in specific technical areas.

ES 6. Benchmarks and indicators utilised to measure progress

At the United Nations Summit on Environment and Development held in Rio de Janeiro in 1992, it was resolved that a core set of indicators be developed in order to measure and assess progress towards achieving sustainable development. This list of indicators comprises indicators applicable to the issue of land degradation in Barbados. These are:-

1. annual rates of erosion
2. downstream siltation
3. degree of flooding,
4. extent of activities threatening erosion,
5. extent of soil conservation measures employed
6. rainfall levels.

ES 7. Conclusion

A few areas can be identified as hindering Barbados' efforts to encourage effective environmental management and in so doing fully adopt the CCD:

- I. Lack of funding and technical expertise.
- II. Lack of inter-sectoral co-operation. The efforts of environmental agencies are dispersed, there needs to be a more co-ordinated approach to issues pertaining to the environment. information transfer among organisations and institutions also needs to be enhanced. A more cohesive programme needs to be encouraged among the environmental sector.

- III. Insufficient incorporation of environmental considerations into development proposals by the private sector.
- IV. Education of the general public is not widely seen as a priority issue. It should be realised that environmental education needs to be promoted at all levels.
- V. Development strategies have not given enough consideration to the limited and exhaustible nature of environmental resources.
- VI. The constant low priority given to environmental issues primarily due to the fact that those projects geared to bring in large economic incentives are usually those with possible negative environmental effects.

With the necessary aid, specifically monetary assistance to provide for increased human resources and project implementation, training of current staff and provision of equipment, Barbados would be well underway to implement projects geared towards mitigating the effects of desertification and implementing measures to assist in periods of drought.

1. INTRODUCTION

On May 14, 1997 Barbados signed the United Nations Convention to Combat Desertification and Drought. The Convention came into force for Barbados on 14 August 1997.

The Convention is committed to combatting the problems of land degradation in arid, semi-arid and dry sub-humid areas. To a water scarce country with a history of land degradation problems most noticeably in the Scotland District, the development of such an international instrument is of major national interest and benefit.

1.1 Brief Look at Barbados

Barbados is the most eastern Caribbean island. It is located at 13.4N, 54.4W and is 166 square miles. The island, which is less than one million years old, was created by the collision of the Atlantic crustal and Caribbean plates, along with a volcanic eruption. It is geologically unique, being actually two land masses that merged together over the years.

The Scotland District, which comprises 1/7 of the island, is the area in Barbados most affected by land degradation.

1.2 The Relevance of the Convention to Barbados

Desertification, as defined by the Convention, refers to land degradation in arid, semi-arid and dry sub-humid areas resulting from factors such as climatic variations and human activities. This is an issue for Barbados because soil erosion and loss of soil fertility are major problems experienced in the Scotland District, which represents one-seventh of the island's land mass. Other parts of the island also experience instances of land erosion however it is not as spectacular as that which occurs in the Scotland District. Therefore most projects addressing the issue of soil erosion refer to the Scotland District area. Barbados is considered to be a water scarce country by the United Nations

Development Programme (UNDP) and the Food and Agriculture Organisation (FAO), and has in the past experienced spells of drought. Water scarcity in Barbados is a critical issue as it has a high population density and has a number of water intensive developments such as golf courses and other tourist related activities.

Prior to Barbados becoming a signatory to the Convention, the Government of Barbados already had various programmes in place to deal with the soil erosion that was occurring in the Scotland District as well as with the water scarcity problems experienced on the island. Any plans and policies may therefore only indirectly address the principles and mandates of the Convention. Subsequent to acceding to the Convention, a National Focal Point and National Coordination Body were put in place to deal with the relevant issues as set out in the Convention.

1.3 Report Format

This report focuses on the policies and programmes which Barbados currently has in place to address the issues concerning desertification and drought. Although these programmes were not instituted as a direct result of the UNCCD they nonetheless address the issues. Barbados currently does not have a National Action Plan in keeping with the UNCCD but this process is underway. The report also draws attention to areas in which Barbados needs assistance to allow effective implementation of the UNCCD.

The report begins with a general introduction in Chapter 1. Chapter 2 provides an overview of the general policies which Barbados has in place to encourage sustainable development and are directly applicable to desertification and drought. Chapter 3 discusses the institutional measures taken to implement the Convention with specific reference to the National Coordination Body and strengthening of relevant agencies. Chapter 4 illustrates the use of consultation among stakeholders in identifying solutions to combat land degradation and drought. The use of the participatory approach to solving environmental issues is highlighted in Chapter 5. Chapter 6 examines financial allocations for the desertification programme and Chapter 7 addresses benchmarks and indicators used to measure the extent of desertification and drought in Barbados. The report concludes with

an overall assesment which offers explanations as to why Barbados has difficulties in fully implementing the UNCCD and suggests mechanisms which would assist Barbados in fully meeting its obligations to the UNCCD.

2 Strategies Established Within the Framework of Sustainable Development Plans and/or Policies

The Government of Barbados has put in place policies and programmes aimed at achieving sustainable development in accordance with the principles of Agenda 21. This chapter provides basic information on the areas in which policies exist. Although some policies may be applicable to the UNCCD, they were developed prior to Barbados' accession to the Convention.

The Barbados National Report to the United Nation Commission on Sustainable Development prepared by the Ministry of the Environment, Energy and Natural Resources, identifies a number of plans and policies which have been implemented or are currently being placed in action to implement Agenda 21. Areas identified for which Barbados has either a policy, programme or legislation consistent with Agenda 21 include combating poverty, atmosphere, land use planning, forestry and deforestation, desertification and drought, sustainable agriculture, biological diversity, freshwater management, energy, transport and sustainable tourism.

2.1 Policies and Plans Relevant to Desertification and Drought

In Barbados, the issue of desertification is addressed through policies on land resources. The Town and Country Planning Development Office of the Ministry of Finance and Economic Affairs is primarily responsible for land resources allocation and physical development. In addition, the Ministry of Agriculture and Rural Development also has responsibility for land resources management. In Barbados, there exists a land-use zoning policy which restricts use determined by the location of underground water reserves. The Physical Development Plan (1998), developed every ten years, speaks to the use of land resources and specific issues which may need to be addressed for development on certain sites. The Plan designates land use zones and categories which may affect available development options.

2.1.1 Draft National Physical Development Plan (1998)

This document is intended to provide a vision for the future growth and development of the Nation by setting out policies to guide relationships among land uses, community facilities and physical infrastructure. It is prepared by the Town & Country Planning Development Office which has responsibility for all land use planning decisions in Barbados.

Specific reference is made to erosion-prone lands which will be subject to a policy whereby all applications involving residential development or the construction of permanent structures will be reviewed by the Soil Conservation Officer. Permission is not to be granted to those developments which are to be placed on sites susceptible to erosion or slippage.

2.1.2 Area Development Plan

The ADP which was developed in a project undertaken by the Town and Country Planning Development Office which examines agriculture and non-agricultural land classes, as well as the future land use policies affecting agricultural land. The ADP carries out its evaluations against the background of a more detailed GIS mapping and resources analysis than the draft National Physical Development Plan. The policy proposals are available for inclusion within the PDP to provide that plan with detailed policy for those areas with which this study has been charged.

The ADP's Terms of Reference requires that it take into account and be consistent with the PDP. In this regard, the PDP lays the foundation for the ADP by establishing basic principles and policies.

2.1.3 The National Park Development Plan 1998 (Final Draft)

This plan seeks to promote land management within the designated park boundaries in such a way that the biodiversity of the various ecological systems are preserved and enhanced for the benefit and enjoyment of the Barbadian society. The National Park boundaries which include the Scotland District, encompasses a landscape that has, until relatively recently been intensively farmed over three centuries, and is typified for the most part by private land ownership.

2.1.4 The Environment and National Resources Management Plan (1998)

The ENRMP addresses the issue of sound use and development of all natural resources in the island in a manner that is harmonious with the natural ecosystems. In so doing, it seeks to achieve the overall goal of sustainable development through which both current and future generations will continue to enjoy and be sustained by the environment. Its purpose is to underline, with as much emphasis as possible, the importance of maintaining the high quality of all the environments that impart beauty and diversity to the Barbadian landscape.

2.1.5 The Medium Term Macro-Economic Strategy (1996-1999)

Development policies enunciated in this document establish the Government of Barbados' intentions and expectations for each sector of the economy over the medium and long term. The strategy emphasises restructuring and revitalising the sugar industry, support for the Barbados Agricultural Marketing Cooperation (BAMC), Independent Producers and for small farmers. Continued emphasis on diversification in the non-sugar sub-sector and expansion of the irrigation development programme to boost the agricultural sector are presented as major objectives.

2.1.6 Integrated Coastal Zone Management (1998)

Various sections of this policy document are significant for the ADP in terms of the concern it raises in regards to land use and resource use in the agricultural sector. The concern has been expressed that run-off containing toxic substances originating from the misuse of pesticides from agricultural production, contaminate water supplies and affect marine life.

2.1.7 Barbados Tourism Development Plan (1998)

The Tourism Development Programme sets out the framework for development of an integrated rural land use policy bringing greater tourism access and sustainable tourism development to rural areas, such as the Scotland District.

2.1.8 National Tourism Policy

The National Tourism Policy also addresses the issues of land degradation and water conservation as these resources are vital to the prosperity of this industry. The broad policy objective of this sector incorporates sustainable development principles through conservation of natural resources. Programmes implemented in this sector include the Water Conservation and Management Project for the Barbados Tourism Industry and the Coastal Conservation Programme.

2.1.9 National Water Conservation Plan

This plan has been accepted by the Board of the Barbados Water Authority (BWA) and is currently in the implementation phase. The Barbados Water Authority is the agency in Barbados responsible for the management of our water resources. The National Conservation Plan comprises two parts, long-term ongoing measures and short-term temporary (emergency) measures.

Long-term conservation measures at the distribution system level essentially involve reduction in losses from the system which may be achieved by:

- i. reduction of leakage in the distribution system;
- ii. reduction of pressure in the distribution system

Long-term conservation measures at the consumer level include:

- i. universal metering;
- ii. pricing and tariff structure;
- iii. low water use fittings “rebate”
- iv. educational programs and information dissemination; and
- v. rainwater catchments

There are five main short-term measures that will effectively enable conservation of water resources in a drought or emergency situation. These are:

- i. temporary pressure reductions

- ii. temporary shut-down of parts (or all) of the system on a rotational basis;
- iii. temporary increases in the second and subsequent tariff blocks
- iv. temporary licence restrictions on private abstractions;
- v. voluntary reduction appeals

It should be noted that the measures have been developed to attempt to maximise voluntary reductions, before moving to penalising measures (i.e increasing block tariffs), pressure reductions, and , as a last resort, system shutdowns.

2.2 Desalination as a Solution

Background

The total water resources of Barbados are estimated to be equivalent of 350 cubic meters (m³) per person per annum: the island is therefore classified as a water scarce country by the Food and Agriculture Organisation (FAO) and United Nations Development Programme (UNDP).

There has been a steady increase in water consumption levels which can be attributed to growth in the economy and increased living standards. The thriving tourist industry depends heavily on water intensive activities such as golf courses. A significant increase in the level of unaccounted-for water also contributed to this increase. In 1993, Barbados experienced a drought which was followed in 1994 by the most severe dry season recorded in 150 years, as a result of which approximately 3,000 households, mainly in the higher, central areas, suffered prolonged water outages.

Facing the prospects of less than enough water to satisfy the Barbadian population, the BWA contracted a consultant to examine the feasibility of establishing a desalination facility in Barbados.

In August 1997, the Planning and Priorities Committee, a sub-committee of the Cabinet, examined a submission on a “Framework for the Development and Management of the Water Resources of

Barbados” and accepted among other things, the recommendation that desalination was a viable option for augmentation of Barbados’ potable water supply.

Managing the Water Supply

The extreme experience of 1994 served to confirm the need for a more systematic approach to water demand management and conservation. As a result, the BWA:

- i. officially imposed a prohibition on non-essential water use as provided for in the act;
- ii. increased leak detection efforts through the creation of a separate Waste Control Unit
- iii. accelerated its mains replacement programme to the point where mains replacement is presently at a rate of 50,000 ft per annum
- iv. aggressively pursued the introduction of universal metering, so that by December 31, 1997 not only had 15,000 new meters been installed under the South Coast Sewerage Project requirements, but the BWA had also installed an additional 10,000 new metres. This combined effort has increased the percentage of metered services from 26.7% to 55.6%
- v. introduced hydraulic network modelling as an aid to improved distribution system operation and design
- vi. made application for approval of a new tariff structure which would encourage water conservation
- vii. taken measures to increase public awareness on water issues through the establishment of a Public Relations Unit
- viii. sought the introduction of legislation requiring the installation of rain water storage tanks in larger new building.

According to the Water Resources Management and Water Loss Study the principal constraints hindering Barbados from achieving a sustainable water supply for the next 20years are:

- i. a lack of consistent and appropriate data upon which management decisions can be made; and

- ii. a lack of technically qualified personnel capable of interpreting that data and implementing the appropriate responses.

These issues are still relevant to date and it is recognised by the relevant authorities that they need to be addressed.

2.3 The Emergency Drought Management Plan

A Drought and Emergency Plan was approved by the Planning and Priorities Committee in 1997. This is a plan of action with respect to drought. It identifies parameters that would be used to monitor, forecast and predict the impact of drought. Such parameters include – rainfall measurements, ground water measurements, salinity and weather data from the Meteorological Office as well as reservoir levels. As a result of this, the BWA has now started looking at establishing a rainfall-gauging network to supplement the existing network so that an estimation could be made on the impact and variation of rainfall. This process could be accelerated if additional personnel were made available to the Meteorological Office and Water Authority.

It is recommended, by authorities in all the relevant agencies that address the issue of drought, that national definitions for drought be established for each sector. What constitutes a drought for agriculture may not be a drought for the water authority, hence water authority may not see the need to implement the measures to mitigate the effects of drought which they have in place.

A water supply system can never be drought-proof, however, measures can be adopted which minimise the impact of emergencies and drought on consumers. The Emergency Drought Plan seeks to define the conditions under which a drought-induced water supply emergency exists and to specify the actions that are to be taken in response.

The main objective of this plan is to ensure that all consumers are supplied with enough water to at least meet their basic needs. From a health perspective, each consumer should have eleven (11) imperial gallons per person per day (fifty (50) litres per day) of water. The 1996 Water Resources

Management and Water Loss Study (WRM&WLS) selected a value of 1422mm (56”) as the design annual average precipitation (rainfall) for Barbados and determined a design drought value of 1066mm (42”) as opposed to the value of 1016mm (40”) used in the 1978 Water Resources study. A drought situation therefore results when the level of the average annual precipitation falls below average.

A statistical review and analysis of available island-wide annual rainfall average figures for the period 1847-1993 were carried out in an effort to characterise the rainfall patterns. When all records are considered, approximately 55% of the annual rainfall figures were below the long-term average. However, during El-Nino years and there are 56 El-Nino events corresponding with this rainfall-data period, the percentage of below average rainfall is higher at 64%. This means that 64% of the time during an El-Nino event, a drought occurs. This preliminary analysis of rainfall data, however, serves to indicate that there is a higher probability of experiencing droughts during El-Nino years than during non El-Nino years. It is noted that further work is needed in this area to determine the magnitude, duration and frequency of occurrence of these droughts. This study could be undertaken if funds were made available to increasing the personnel working at the Meteorological Department and other related sectors,

Emergency/drought management plan activities have been formulated. The activities are categorised as follows:-

Short term;	0 – 6 months
Medium term	6 – 12 months
Long term	greater than 1 year

2.3.1 Summary of Plan Activities

SHORT TERM

1. Multi-agency Drought Task Force
2. BWA Drought Task Force

3. Drought Indicators

4. Response stages

5. Financial/Administrative activities for plan

6. Technical

1. Management

- I. Distribution Management System
- II. Tanker Management plan
- III. Shut off/rationing plan

2. Water Resources/Supply

- I. Make all BWA wells operable
- II. Major private wells
- III. Desalination

3. Distribution system activities

- I. Identification of perennial problem areas
- II. Universally metering of problem areas emphasis on lower elevations)
- III. Waste Control (leak detection and repairs)
- IV. Flush/swab specific distribution areas and make (where possible) dead-end lines continuous
- V. Installation of appurtenances (pressure reducing valves , air valves)
- VI. Purchase/Installation of temporary tanks
- VII. Use of the Hydraulic Network Model

MEDIUM TERM

1. Administrative

- I. Prepare guidelines for institutions and Government for existing facilities to install tanks to harvest rainfall for non-potable uses.
- II. Review and modify Act in relation to emergency actions

- III. Institute procedures to ensure that developments are approved with minimum dead-lines

2. Technical

- I. Reorganise distribution Superintendent regions on island
- II. Examine the feasibility of importation of water from other Caribbean islands

LONG TERM

- I. Reduce Unaccounted-for-water in the distribution system in the distribution system to 30% or less
- II. Implement desalination.
- III. Implement the Supervisory Control and Data Acquisition System (SCADA)
- IV. Use the Hydraulic Network Model in other distribution systems
- V. Incorporate the use of dual reticulation systems into the building code
- VI. Encourage the reuse of wastewater for appropriate non-potable purposes
- VII. Examine and encourage blending for agricultural purposes
- VIII. Fast track ban on the importation of all non low flow water use fixtures

2.4 Legislation Review

Barbados has no forest legislation, but several enactments promote conservation of trees. The Cultivation of Trees Act (1951) provides income tax incentives for the establishment of woodlots of approved tree species. The Tree Preservation Act (1981) imposes a prohibition on the harvesting of trees generally, however licenses may be issued by the Ministry of Agriculture and Rural Development under specified conditions for the felling of trees. This Act was passed to consolidate the acts of this island relating to the cultivation and preservation of trees. It not only put in place an incentive for the public to plant trees, but also protected the land on which the trees grew and provided an incentive where no tax was paid on land on which one acre or more already had forest. It however appears limited in its operation as it only applies to trees which are more than one metre in circumference.

Of particular relevance to land erosion problems is the Soil Conservation (Scotland District) Act (1959) designed to protect and rehabilitate the vulnerable soils of the Scotland District through the activities of a Soil Conservation Board. The Board may, through the Chief Agricultural Officer and within the limits of the Scotland District, determine land use patterns and crop distribution, methods of cultivation and limitation of livestock density, preservation and control of watercourses and the fencing and reforestation of selected areas.

This region has long been known for its geological instability and soil erosion, which has caused the demise of sugar plantations and resulted in widescale abandonment of the land. Efforts carried out by this board include small-scale tree planting programmes and protection of pockets of woodlands for prevention of erosion, as well as engineering structures to stabilise localised land movement. However, indications suggest that the SCU has been inadequately staffed and financed in recent years and has barely coped with critically needed structures and maintenance.

As part of the recent EMLUP study, a revision of the environmental legislation for Barbados was done . This study found that the current legal framework is a patchwork of statutory provisions created in an era when comprehensive environmental management was not an objective for

government. Most legislation currently on the books is not relevant or applicable to modern environmental problems. This study also pointed out that the fragmentation in legislative regulation of environmental management and the absence of an institutional focal point to give policy direction and co-ordination, result in the ad hoc and ineffectual responses to problems as they emerge.

A report on Legislation and Institutions was prepared by consultant Winston McCalla in 1991 through funding from the CARICOM Secretariat in association with the Ministry of Agriculture, Food and Fisheries. The report was based on:

- i. The need to rationalise the existing related legislation to make the laws more effective and enforceable;
- ii. the need to centralize environmental and land use planning; the drafting of legislation aimed at providing the legal framework for the establishment and conservation of national parks and protected areas;
- iii. the need to develop more effective enforcement mechanisms for any new legislation.

The report found that many statutes touch and concern the same areas, and matters relating to the same issues are often found spread over a number of Acts. Currently an Environmental Management Act is in draft, this should form a cohesive link among the relevant legislation relating to environmental issues.

3. Institutional Measures Taken to Implement the Convention

To facilitate implementation of the UNCCD, Barbados appointed a National Focal Point and established a National Coordination Body. The Ministry of the Environment, Energy & Natural Resources was appointed as the National Focal Point and a Committee comprising members from various agencies closely associated with the issues of desertification and drought was convened by the Ministry and forms the National Coordination Body.

3.1 National Coordination Body

The NCB acts as an advisory body and has neither legal status nor financial autonomy. It has the clear mandate to find potential solutions to the problem 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, thus empowering the resource users towards management. The NCB is a cross-sectoral committee comprising persons who have expertise in areas relevant to desertification and drought. There is no dedicated staff to help the Committee carry out its work but an Environmental Officer in the Ministry of the Environment who is expected to provide support to the Committee. The Environmental Officer acts as Secretary to the committee and also as the Permanent Secretary's designee in matters related to desertification and drought. The Officer also has responsibility for the Convention on Biological Diversity (CBD), which can be considered related to the UNCCD, and is also currently involved in a number of other programme areas.

3.1.1 Financial Resources of the NCB

Financial resources allocated to desertification are made available from the budget allocation from the Government of Barbados to the Ministry of the Environment, Energy and Natural Resources. Funds used by the Ministry are spent on policy related issues and public awareness activities. In 1999, the allocated amount was 1/10 of the allocation for biodiversity under which the programme

for desertification falls and in 2000, 1/10 has also been allocated to desertification. The Ministry's budget for biodiversity ranges from BDS\$12,000 to BDS\$18,000 or US\$6,000 to US\$9,000 annually.

The Soil Conservation Unit, falls under the Ministry of Agriculture and Rural Development, and is responsible for infrastructural work related to desertification control. In the 1997-1998 budget, actual expenditure for structures was BDS\$ 702, 145 (US\$ 351,072) and in 1998-1999 it was BDS\$840,601 (US\$420,300). This money was used to provide for watercourses and land stabilisation, irrigation development, sub-surface drainage and Scotland District development.

3.1.2 Composition of the NCB

The present Committee is made up of representatives of Government agencies. However, the Barbados Agricultural Society (BAS) and Soil Conservation Unit (SCU), which are represented on the Committee, interact with a wide-cross section of interest groups including the local community farmers. Non-Governmental Organisations that directly represent social and economic sectors relevant to desertification will be included in the preparation of the National Action Plan. In choosing members to sit on the NCB, letters were sent to the various interest groups asking for a representative from the department to be nominated to sit on the Committee. Previously Committee meetings were held on an *ad hoc* basis, however since January 2000, committee meetings have been scheduled for once a month although this is extended to once every two months if there are no pending issues to be discussed.

3.1.3 Work Programme of the NCB

A work programme and timetable are currently being prepared to facilitate a more coordinated approach to the work of the NCB. The objective of the Committee is to communicate the importance of biodiversity conservation in areas such as the Scotland District and its importance in the prevention of land degradation and its role in water conservation. This will be achieved by undertaking site visits and informal community meetings in the Scotland District as part of the National Action Plan developed under the National Committee. Some of the actions identified to achieve the objectives include :

- I. the development of public awareness materials
- II. dissemination of public awareness materials at various fora
- III. posting of information on the Ministry's website
- IV. site visits to the Scotland District and one on one discussions with affected persons
- V. preparations of reports on the concerns articulated by the community.

3.1.4 Supervision of the NCB

Since the NCB falls under the Ministry of the Environment, Energy and Natural Resources, supervision, control and evaluation of the work and progress made is done by the Ministry. It is expected that in the future the Ministry of Agriculture and Rural Development will play a more active role in the work of the NCB and addressing desertification issues in general.

3.1.5 Existing Databases

The NCB does not have its own information system capacities neither does it maintain a database except that of member information and minutes of meetings. The development of an inventory of resources inclusive of soil types and location, volume of water resources and available technical resources is needed. It is recognised that although this information already exists, what is needed is the compilation and augmentation of the information into one comprehensive computerised database.

There are some other databases which were prepared during the Environmental Management and Land Use Planning (EMLUP) Study which may have particular relevance to desertification, these include databases such as those identifying areas of active slippage and drainage slopes.

As part of the Scotland District Soil Conservation Study, a preliminary report was prepared for the Ministry of Agriculture and Rural Development, which principally targets the use of GIS to achieve such goals as the location, mapping and characterisation of erosion and degradation of lands in the Scotland District. This project is scheduled to begin later in the year.

These maps will represent the starting point in the establishment of a dynamic GIS. It is envisaged that maps will be updated and the information database is maintained by the Soil Conservation Unit. The aim of the study is to capture, store and analyse information on soils, geology, slope and rainfall, the study should highlight suitable methods of future land management aimed at avoiding the worst effects of land failure and erosion.

3.1.6 Information Transfer Among NCB/NFP Members

Information is promoted internally and externally by NFPs/NCBs via telephone, fax, e-mail.

3.2 Institutional Strengthening

No specific national strategy or policy exists for strengthening national institutions and administrative capacity to ensure compliance with environmental laws and standards. Each institution deals with the issues of administrative and technical capacity as appropriate. However, Environmental Management and Land Use Planning for Sustainable Development (EMLUP) Study has produced the Environmental Management Plan which makes recommendations to the management of the natural resources of the country.

3.2.1 Institutional Strengthening of the MEE

The EMLUP Study also recommended ways in which the Government could “strengthen the institutions and eliminate fragmentation of responsibilities for environmental matters across the numerous different agencies, and promote consolidation of authority on environmental issues”.

The Terms of Reference requested the consultants to:

- I. Review the existing institutional structure concerning environmental and natural resources management, focussing on the Environmental Unit. This review should take into account the institutional analysis generated by other studies.
- II. Devise a regulatory and administrative framework for environmental management that would ensure effective enforcement of and compliance with the guidelines, regulations and procedures developed to eliminate and/or mitigate the negative environmental impacts of development projects and programmes.
- III. Make specific recommendations for the institutional strengthening required to enable the Environmental Division to effectively carry out its designated functions including the revision and implementation of the national environmental education and training programme and emphasizing the staffing requirements and training needs of the Unit.
- IV. Make recommendations for institutional strengthening of the institutions involved in national resource management.

The recommendations of the project for the strengthening of the institutional structure for the management of environmental resources and of the Ministry in particular have been presented to the Government and are under review.

3.2.2 Institutional Strengthening of the Soil Conservation Unit

The Soil Conservation Unit is the primary agency involved in the Scotland District and it too is in dire need of capacity building. Much is expected of this Unit, however the resources, both human and financial require upward adjustments. The SCU is responsible for addressing the structural integrity of the area through road maintenance, ridge stability and bio-stabilisation. There are currently three technical officers to manage approximately 150 workers with little external technical assistance. Positions for soil conservation specialists, agronomists and geologists do not exist at the SCU and there is only one field extension officer. The staffing of the SCU requires urgent attention if the SCU is to effectively function at full capacity.

4. Consultation Process to Formulate the National Action Plan

At the core of the UNCCD is the need for local community participation. This Convention promotes the participatory approach to solving the problems of desertification and drought. In Barbados, the Ministry of the Environment, Energy and Natural Resources also sees the participatory approach as the way forward in resolving environmental problems. Local communities are the primary resource users and their support is a vital part of any environmental management strategy.

Consultation with relevant stakeholders are held in order to facilitate the participatory approach to dealing with desertification and drought problems in Barbados. Further consultations are planned to assist in the preparation of the National Action Plan. One such consultation has already taken place in the form of a National Workshop. From this meeting, initial recommendations on how to address the issues of desertification and drought were proposed. The UNCCD Secretariat funded this workshop.

4.1 The National Workshop on Land Degradation, Desertification and Drought

A review of the mechanisms for co-ordination and harmonisation of actions to combat land degradation at national and local levels was undertaken at a National Workshop on Land Degradation, Desertification and Drought held May 31 – June 1, 1999. The forum provided an opportunity to share ideas, identify stakeholders and served to aid in the identification of a more integrated approach to the issues concerning desertification and drought than has been used in the past.

The review led to a number of proposals which when implemented would allow Barbados to better fulfil its obligations to the UNCCD. These recommendations will also form the basis for the preparation of the National Action Plan which will be formally prepared later in the year. Implementation of these measures and proposals, however, requires funds and more trained technical staff which are lacking at the moment.

From the Workshop, three areas were identified as areas requiring Action Plans and it is in these areas that the National Action Plan for the UNCDD will focus. The identified areas were agriculture, settlement and resource use & conservation.

4.1.1 AGRICULTURE

The relevant agencies represented at the workshop had the vision that agriculture remain a vital part of the development of the Scotland District, thus contributing towards the reduction in loss of topsoil and the prevention of land degradation. Economic activity through agriculture should be promoted so as to benefit the locals in the area.

Actions proposed to facilitate these aims are:

1. The development of an inventory of resources inclusive of:
 - I. Soil types & Location
 - II. Volume of water resources
 - III. Available technical resources

It was recognised that the information already existed, but what was needed was the compilation and augmentation of the information into one comprehensive database.

2. Development of Programmes to meet the needs of farmers:
 - I. Education
 - II. Cultivation services
 - III. Access to water
 - IV. Access to roads
 - V. Terracing programmes

A number of recommendations were made to facilitate these actions:

- I. Establishment of a performance criteria for the land owners to reduce the
- II Burden of management by Government;
- III. The strengthening of the Soil Conservation Unit (Ministry of Agriculture & Rural Development);
- IV. Further augmentation of water resources;

- V. Re-education of farmers utilising the 4H organisation; and
- VI. Development of high value/exotic agriculture where possible through farm cooperatives.

It is recognised that a project approach is necessary to the implementation of an Agricultural Action Plan specific for the Scotland District but this needs to be more extensive than the current practices of the education of the farmers. It must be recognised that the cost of implementation of conservation measures and action plans in the Scotland District should not be seen as an obstacle as funds could be sought externally.

4.1.2 SETTLEMENT

The management of settlement and associated activities as they relate to land degradation within the Scotland District needs to be addressed. The specific objectives of which would be to improve management of existing settlements, combating degradation associated with settlements and rationalising and planning for present and future settlements.

Implementation of this was suggested through three scenarios. The first involved removal of all settlements which was seen as socio-politically not feasible.

The second scenario involved the development of a comprehensive and integrated land use management plan for the Scotland District, which should review and include the policy recommendations of the EMLUP and the 1998 revised Physical Development Plan which has at its base three designated areas for future settlement development.

The third scenario was a demonstration project which demonstrates the objectives on a small scale.

It was discussed that technocrats need to not only present policy recommendations to decision-makers but also present the implications of the different scenarios if the appropriate measures are not pursued.

4.1.3 RESOURCE USE & CONSERVATION

Conservation and appropriate use of water, arable land, sand, clay, oil, flora and fauna and people is the vision for this area.

The aim is to utilise an integrated information approach based on the available body of knowledge in conjunction with consultation with stakeholders, for use in an integrated management system to:

- 1) Preserve and enhance flora and fauna;
- 2) Sustainably utilise mineral resources; and
- 3) Preserve and foster the socio-economic and cultural activity of the area, to the benefit of Barbados as a whole.

The relevant stakeholders were identified and overall sensitisation and education of all key groups in the Scotland District via consultations and information exchange was emphasised.

5. Participatory Approach to Combatting Desertification and Drought

5.1 Public Awareness Activities

In Barbados, much emphasis is being placed on public awareness and communication by the various sectors involved in the issues of desertification and drought.

5.1.1 Arbor Day

In 1997, the National Conservation Commission agreed that a more co-ordinated approach should be taken regarding the planting and maintenance of trees. Further in an effort to increase forestation on the island, a committee was established to formulate plans on how best to involve and encourage the local people in the island wide planting of trees. The Committee comprises the following agencies:

- I. Ministry of the Environment, Energy and Natural Resources
- II. Barbados Environmental Association
- III. Soil Conservation Unit
- IV. Barbados National Trust
- V. University of the West Indies
- VI. Barbados 4-H Foundation

The objectives of the Committee were:-

- I. To establish a national day for tree planting
- II. To sensitise the general public about the importance of trees
- III. To encourage community groups and schools to assist in the preservation of the environment
- IV. To establish an education programme for schools
- V. Reforestation

The National Conservation Commission, which serves as the chair for the Arbour Day Committee, had as its main strategy the aim of sensitising the public via advertisements on radio and television about the importance of planting and having trees. The Committee at one of its earlier meetings decided that a day – National Arbour Day- should be established to signify the importance of planting and having trees. This day is celebrated on September 22.

The Committee determined that its objectives for schools and communities each, would be twofold. For schools, the short term goals included planting of trees at primary and secondary schools in collaboration with National Trust, Children's Association for the Protection of the Environment (CAPE) and the Barbados 4-H Foundation as well as the compilation of a teaching manual on the how and why of planting trees. The long term goals placed an emphasis on the integration of projects into the curriculum of schools as well as to have schools actively involved in the propagation of seedlings annually for Arbour Day.

For communities, the short term goals were to target the neighbourhood watch programmes to encourage those in the neighbourhood to plant trees, which would develop into a community garden project as well as the production of a booklet focusing on tree planting and aftercare. The long-term goal was to develop a quarterly outreach programme.

During 1998, the Arbor Day Committee, in continuing its efforts to sensitise persons on the need for a healthy environment decided to focus on householders. These efforts would compliment those being made with the children at both primary and secondary schools and within the community.

To ensure that the householders were involved, contact was made with the Division of Youth Affairs and an agreement was reached whereby the Youth Commissioners would assist in the distributing of information and plants.

Correspondence was forwarded to the businesses in the private sector. Encouraging them to plant trees on their properties. This endeavour was well received and several trees were requested.

Further a booklet on the importance on planting trees, why, where, when, how and aftercare was produced and distributed for Arbour Day, 1998.

The Arbor Day Committee was also involved in the coastal revegetation project which was being conducted by the Coastal Zone Management Unit. The main focus of this project was to establish/enhance the framework for a working partnership among private enterprises, communities, NGO's and government for sustainable use, revegetation and protection of systems.

Emphasis was also placed on promoting the concepts of Arbor Day and sensitise the populace by all mediums possible – i.e print and electronic media. Contact was made with representatives from the National Publishing Company and the Government Information Service. Promotion of Arbor Day was also done through PR Image Consultants. Articles were prepared by Committee members and were forwarded to the Nation Publishing House for insertion in the daily papers.

The Committee also envisaged that planting would be conducted all during the rainy season and not only during Arbor Week.

The following are some of the achievements for Arbor Day 1998:

- “ Plants were randomly distributed to several householders via star Com Networks’ roadrunner programme
- “ Members of the Committee promoted National Arbor Day via the television programme- “Wake Up Caribbean”
- “ Tree planting was done at areas under the responsibility of the NCC
- “ A major coastal revegetation exercise was conducted at Walkers Bay and Barclay’s Park, St. Andrew to protect the sand dunes.
- “ Planting exercises were conducted at thirty-three primary and secondary schools
- “ The booklet was prepared and distributed mainly to the schools across the island

In 1999, National Arbor Day and the Schools' Nursery Development Project were successfully launched on September 22.

The objectives of the Schools' Nursery development Project are noted below:

Develop public education programmes in support of biodiversity conservation through:

- I. the creation of programmes on education about natural ecosystems, especially gullies, mangroves and coastal woodlands and water cycles.
- II. the development support and participation in the preparation of educational materials relevant to raising awareness and understanding of the importance of biodiversity and its conservation.
- III. to initiate outreach programmes which take biodiversity messages into the local communities and schools.

Support sustainable use of the national flora:-

1. by documenting and disseminating indigenous knowledge (on plants and their uses, especially medicinal uses) of the national flora.
2. developing appropriate seed and propagule collection and propagation procedures for the species of the national flora.
3. developing programmes for the conservation of endangered cultivated plants, including land races and varieties.

5.1.2 Water Conservation Programmes

The Barbados Water Authority is also involved in a public education programme as they envisage it an important part of any water conservation programme. Programmes such as these need the support of the consumer if they are to be effective. It is necessary that the public be made aware of the scarcity of the water supply, and the costs associated with the extraction, treatment and distribution of the water supply should be conveyed to the consumer so that they understand why water conservation is necessary. These programmes should be on-going, however, they really only take effect during the drought.

With respect to water conservation, a public education campaign has been launched by the BWA that started with the free distribution of low water use showerheads and kitchen faucet Aerators to customers not in arrears (30,000 were distributed). Special programmes are also in place to work with the private sector in the implementation of water conservation projects. Currently the BWA is working with the Ministry of Education on a school project where a private sector supplier of low water use fixtures has retrofitted the water fixtures at the school for free and water use is being logged and monitored. The BWA, EED and Ministry of Tourism are also collaborating to implement a Water Conservation and Management Project in the Tourism and Hotel Sector.

5.1.3 Coastal Conservation Programme

The community surrounding Barclay's Park in St. Andrew were the main participants in this effort. The project was implemented between April 1998 and March 1999 and during this period a concerted effort involving the community, government service organizations and the private sector was made to provide the much needed finance, technical expertise and manpower to effect successful implementation of the project. The demonstration project focused on practical solutions to the threat of dune instability. The main problems at the site can be summarised as follows:

- I. Available sand to replenish the beach system is being diminished by ongoing and sometimes uncontrolled mining operations
- II. Periodic erosion by wind and sea is partly due to low vegetation cover in areas
- III. The stripping of vegetation for landscape maintenance creates unnecessary exposure in certain zones
- IV. Stripping of vegetation to gain access to sand, also results in exposed zones in the sand dune and increased soil erosion
- V. Largely unsuccessful efforts by planning agencies to curb illegal practices
- VI. Rehabilitation practices in mined areas have not been well executed since in many cases no in-filling has occurred and trees have been planted in excavated zones
- VII. Lack of awareness or pure disregard for prohibitive laws and policies designed to protect sand dunes – Beach Protection Act, Soil Conservation Act and Physical Development Plans
- VIII. Private land ownership in many of these areas has reduced the ability of regulatory authorities to execute and monitor rehabilitation
- IX. Inadequate resources, combined with competing demands for scarce resources to execute other programmes which are considered to be of greater social and economic priority

The purpose of the project was to establish a framework for a working partnership among business enterprise, the community, NGOs and Government for sustainable use and protection of dune systems in the island, and to put this partnership to work on practical activities.

Key project outputs that have been substantially achieved are:

- I. An enhanced Arbor Day Committee (with the addition of the Coastal Zone Management Unit),
- II. Stakeholders who know how to access and mobilise each others' resources
- III. Dune stabilisation and coastal revegetation strategies have been tested
- IV. Monitoring programmes have been set up
- V. Guidelines for maintenance and database management
- VI. A manual for the coastal stabilisation and coastal revegetation project has been produced. The manual currently titled "A Stakeholder Guide to Dune Stabilisation and Revegetation" is a fairly comprehensive reference document.

5.1.4 Soil Conservation Programmes

The Soil Conservation Unit is based in the Scotland District and is the main government department responsible for this area. At present they are involved a number of programmes aimed at reducing the land degradation in the Scotland District.

The SCU is involved in education of farmers with respect to encouraging sustainable farming practices. These practices include teaching them to keep the soil covered, incorporation of organic matter to assist in percolation, encouraging reduction in the use of fertilisers and incorporation of the principles of Integrated Pest Management into their practices.

SCU also holds workshops to educate farmers in the effective use of herbicides, water conservation practices – use of organic matter, collection of rain water from roofs – as well as in methods of

ploughing which reduce land erosion. There are currently plans in place to have a demonstration plot at the SCU to identify the best method of ploughing which would reduce land slippage in the area. The use of engineering structures in the Scotland District is also employed. Gabion structures to reduce surface water run-off which facilitates land erosion are placed in the area to minimise land erosion and the land is terraced to reduce the length of slope.

The introduction of agro-forestry is also being looked at with respect to the Scotland District and Barbados as a whole. The idea being to encourage farmers to plant more fruit trees in addition to the natural vegetation surrounding the land, the fruit trees would serve as an economic incentive for the farmer whilst playing its natural role in soil conservation.

6. Financial Resources Allocated to Combatting Desertification and Drought

Funds for the programme on desertification and drought in Barbados are very limited. Currently any monies needed are sourced from the biodiversity budget. However some monies were allocated in 1999/2000 for public awareness activities and low cost community projects. Any other projects undertaken, were funded by monies obtained from the Convention Secretariat. For the financial year 200/2001, monies are allocated for public awareness from the biodiversity budget, however it is foreseen that these will not be adequate to fully allow for the development of a comprehensive plan for implementation. Biodiversity has a total budget of BDS\$18000 (US\$9000) which has to be split among ten sub areas of which CCD is one.

6.1 NAP Financing

No money has been allocated to formulate the NAP, as this will be undertaken by the committee. Barbados is very keen on preparing its NAP and getting programmes and projects in place and is currently in the process. This process is however retarded by the lack of human resources available to dedicate the necessary time to the CCD programme.

6.2 Technical Assistance Required to Implement the UNCCD

In addition to needing funding, Barbados is also lacking in some areas and requires more technical expertise.

The Meteorological Office would function more effectively if they had an enhanced climate monitoring network. More up-to-date technology and equipment used in weather forecasting would also be an asset and training of available personnel in current fields of meteorology would prove effective in producing more accurate weather forecasts.

The BWA identified areas of assessment of droughts as well as forecasting as areas which could do with additional training. It is currently difficult to determine with existing hydrometeorological data collection system to forecast drought. Also the setting up of a hydrological and hydrometeorological network to monitor and evaluate the water resources and drought would assist in the work of the BWA.

The SCU identified areas requiring training as forestry, water conservation and management, and aquaculture. Currently, their personnel lack technical experience and international consultants are usually brought in when the situation demands it.

In general, personnel currently employed have experience in their various subject areas but require training in specific technical areas.

7. Benchmarks and Indicators Utilised to Measure Progress

At the United Nations Summit on Environment and Development held in Rio de Janeiro in 1992, it was resolved that a core set of indicators be developed in order to measure and assess progress towards achieving sustainable development. Barbados joined the United Nations testing team for the development of Sustainable Indicators in 1997. To facilitate this participation, a Steering Committee comprising experts drawn from a variety of fields including economics, social well being and environmental conservation was formed. This list of indicators comprises indicators applicable to the issue of land degradation in Barbados.

7.1 Identified Indicators of Desertification

The indicators identified for land degradation are identified below:

- I. Annual Rates of erosion - Show the annual rates of erosion. Data was collected (1983-1987) with run-off plots at different sites
- II. Downstream siltation - The amount of erosion as represented by downstream siltation
- III. Degree of flooding/landslides - The amount of flooding and landslides
- IV. Extent of activities threatening erosion e.g. monocultures and overgrazing - The amount of livestock in a particular sloping area; amount of deforestation taking place; density of settlement on slopes; types of farming practices and systems. This is a method of monitoring and controlling land degradation
- V. Extent of soil conservation measures implemented - The amount of terraces, gabion wells, subsurface drainage system network, legislation to control poor agricultural practices, settling, overgrazing etc. This would indicate conservation and preservation
- VI. Rainfall levels - Shows the type of climate one has, the physical environment for crops and what type of crops can be grown

7.2 Monitoring and Data Collection

For each indicator identified, statistical data must now be gathered to further analyse and produce a report on the state of the environment which would incorporate the status of land degradation in Barbados.

Monitoring and data collection of environmental parameters is a key area lacking in all environmental sectors in Barbados, this is primarily due to inadequate human resources to carry out the work.

8. CONCLUSION

Barbados signed the UNCCD because it dealt with issues of concern to the island. Barbados experiences erosion and land degradation and is a water scarce country and is therefore susceptible to instances of drought. However keen interest alone is not enough to allow Barbados to fully implement the Convention as certain measures must be in place to facilitate effective adoption of the CCD principles.

A few areas can be identified as hindering Barbados' efforts to encourage effective environmental management and in so doing fully adopt the CCD:

- I. Lack of funding and technical expertise.
- II. Lack of inter-sectoral co-operation. The efforts of environmental agencies are dispersed, there needs to be a more co-ordinated approach to issues pertaining to the environment. information transfer among organisations and institutions also needs to be enhanced. A more cohesive programme needs to be encouraged among the environmental sector.
- III. Insufficient incorporation of environmental considerations into development proposals by the private sector.
- IV. Education of the general public is not widely seen as a priority issue. It should be realised that environmental education needs to be promoted at all levels.
- V. Development strategies have not given enough consideration to the limited and exhaustible nature of environmental resources.
- VI. The constant low priority given to environmental issues primarily due to the fact that those projects geared to bring in large economic incentives are usually those with possible negative environmental effects.

These obstacles identified above are very applicable to the issues of desertification and drought and are key reasons why Barbados is unable, although very willing, to adopt measures identified in the UNCCD.

With the necessary aid, specifically monetary assistance to provide for increased human resources and project implementation, training of current staff and provision of equipment, Barbados would be well underway to implement projects geared towards mitigating the effects of desertification and implementing measures to assist in periods of drought.

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