

PREFACE

Grenada is in the process of better defining its land use policy. The national parks and protected areas program is an important step towards viewing the finite resource of land in a multiple use context. Grenada's actions in the protection of the upper watersheds and important ecosystems, promotion of cultural and natural attractions, and the development of educational and tourism programs are noteworthy in this respect.

The methodology for the establishment and management of a system of national parks and protected areas was developed by a team of national and international specialists working together under the direction of the Ministry of Agriculture. The inventory of the natural and cultural resource base relied on an interdisciplinary team made up of fisheries, forestry, land use, extension, and physical planning personnel as well as first-hand information of local hikers, naturalists and historians.

In conjunction with this report, and as part of the Government of Grenada/OAS Integrated Development Project, land policy and infrastructure development guidelines have also been defined. A zoning map has been generated to identify productive agricultural and grazing lands, especially in the southeast section of the island of Grenada where development pressures are most intense. The goal of these efforts is to protect and develop the natural resources of Grenada and Carriacou.

The studies in land policy and zoning, national parks, resource conservation, and tourism development are part of the ongoing assistance of the Department of Regional Development to integrated development planning and implementation in Grenada. The experience has provided valuable guidance for the formulation of a methodological approach for the establishment of national parks programs which hopefully can be utilized by other island states in the English-speaking Caribbean.

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EXECUTIVE SUMMARY

Grenada is an island famed for its natural beauty and cultural resources. Elfin woodland dwarfed forests descend to montane rain forests, to lowland dry forests to mangrove and exquisite coral reefs. Lagoons, beaches, bays and rugged cliffs cover the coasts. Grenada has over 450 species of flowering plants and 150 species of birds, indicating great ecological diversity in a relatively small area. Likewise, the island is dotted with a diversity of cultural resources: Carib (Amerindian) archeological sites; historical sites covering over 400 years of history including forts, sugar mills, rum distilleries and estate houses; and living cultures representing unique ways of social, economic and cultural life such as nutmeg, mace, and all-spice estates, artisanal fishing and boat building facilities.

Over the past several decades ever-increasing pressures have been placed on the country's natural resource base resulting in notable increases in soil erosion; sedimentation of river systems and water supplies; hydrological regime imbalances reflected in flooding and drought periods; decreases in agricultural and fisheries productivity; and loss of habitat. Likewise, historic and archeological sites have suffered continued deterioration due to lack of clear responsibility for their management or neglect.

At the same time there is an increasing demand for recreational opportunities and education programs for Grenada's population. Likewise, there is a major need for a much greater variety of developed natural and cultural areas for both nationals and tourists.

In response, the Government of Grenada placed the establishment of a national park and protected areas program as a priority in the development plan for 1986 and requested technical assistance from the Organization of American States, Department of Regional Development. Protected areas form an integral part of the wise management of

natural resources. While protecting a nation's natural and cultural heritage, protected areas play a major role in sustained production and development through their critical support of water quality and supply, forest and agricultural production, erosion and sedimentation control, watershed regime balance, recreation, tourism, fisheries production and environmental education.

A total of 27 areas for Grenada and sixteen for Carriacou are recommended for inclusion within the National Park System. Of the total, three units are recommended as National Parks, eleven as Protected Seascapes, eleven as Natural Landmarks, twelve as Cultural Landmarks, and four as Multiple-use areas. This represents approximately 11,008 acres of terrestrial area or about 13% of the total land surface of the country. In addition, several marine areas are proposed for inclusion within the System.

Of the total land area within the System (excluding Cultural landmarks) 8,505 or 77% of the land is classified as Class VI land which is unsuitable for agriculture due to slope and/or water limitations. Much of the remaining is seasonally flooded or biologically fragile habitat such as mangroves.

Full implementation of the Protected Areas Program will require significant human and financial resources. Initially a position of Manager of National Parks and Wildlife will be created, supported by two forest rangers, but as national education and tourism programs are realized, increased staff will be necessary.

This document is flexible and is intended to adapt to changing governmental plans and policies. As national development strategies and priorities evolve, so too will the National Parks and Protected Areas Policy. Changes in land tenure and land-use, public environmental awareness, and recreational habits are all factors which will help form an effective conservation program for Grenada.



CHAPTER I

INTRODUCTION

The Ministry of Agriculture and Tourism/Organization of American States Project "Integrated Development in Grenada", was directed to prepare a policy and plan for national parks and protected areas for the Country. The policy provides the basis for the establishment and management of a national parks and protected areas program.

Various documents dating to the original explorers and colonizers of the Islands of Grenada and Carriacou note the majestic beauty, lush tropical forests, and varied topography. Now fondly referred to as "the Spice Island", Grenada has been coined the prettiest island in the Caribbean.

Grenada has numerous areas of outstanding natural and cultural value. Proposals for individual parks have been made by international organizations including The Caribbean Conservation Association, Eastern Caribbean Natural Areas Management Program, International Union for the Conservation of Nature and Natural Resources and the World Wildlife Fund; and the National Trust, Ministry of Agriculture and Tourism and the Grenada Hotel Association on a national level. This document attempts to present a realistic national protected areas program for Cabinet approval.

The purpose of the system plan is to identify and provide a course of action for the protection and use of the Country's outstanding natural and cultural heritage and to encourage public understanding, appreciation and use of that heritage in ways which leave it unimpaired for future generations. Of equal importance, the National Parks Programme is to promote and guarantee a continual flow of social and economic benefits to the Grenadian people.

Five management categories have been defined within the system: National Parks, Natural Landmarks, Protected Seascapes, Multiple use Management areas and Cultural Landmarks. The National Parks and Protected Areas System Plan is based on specific criteria such as ecological or geological importance, cultural significance, tourism potential, or recreational value. Units within this system are recommended for establishment by Cabinet. In the case of forest reserves, a sound policy and legislation exists and will remain in effect for the Grand Etang Forest Reserve, and Forest Reserves in Carriacou.

Marine areas are the property of the State. Some of the proposed National Park area is presently managed as a Forest Reserve or is unsurveyed State Land. Most other units within the proposed system are privately owned, therefore necessitating the development of individual management strategies in cooperation with the private owners. The policy allows for private land owners to retain limited management and development rights on parcels of their land, as approved and monitored by the responsible government agency.

Management of the Parks and Protected Areas System will be concerned with the principal function of protection of natural and cultural resources; provision of outdoor recreation, tourism and education programmes; facilities and services; provision of opportunities for research; conservation of watersheds and water production, control of sedimentation and erosion and protection of downstream investments; production of marine products, timber, forage and wildlife on a sustained yield basis; provision of sport fishing and hunting opportunities; and in stimulating use of marginal rural areas.

Management and development plans will eventually be prepared for each unit within the system. As appropriate, specialized plans for interpretive and environmental education or research and environmental monitoring will be prepared for those units where the

circumstances or objectives warrant such. Plans will be evaluated on a regular basis in order to improve both planning and execution.

The responsible management agency will develop a short and long-term funding strategy to finance the system and its activities. Components of the strategy will include funds allocated by Government; an effort to obtain financial and technical assistance from various international and bilateral sources and financial support from the national private sector; and, the establishment of special protected areas development and management funds based upon a set of fees charged to users and beneficiaries of the national system of parks and protected areas. Initially a fairly heavy reliance will be placed on international and bilateral support.

The Ministry of Agriculture and Tourism will be delegated the responsibility for the planning, management and protection of areas within the parks and protected areas system. Extensive collaboration and coordination with a number of other public and private agencies will be developed to support those efforts.

CHAPTER II

GOVERNMENT POLICY RELEVANT TO NATURAL AND CULTURAL AREAS PROTECTION

No formal Government policy exists on the establishment and management of a system of protected areas. Various policies are, however, directed towards the objectives and goals of Government in the area of conservation and protection of natural and cultural resources.

The following national policies provided the basis for the draft policy for National Parks and Protected Areas.

Goals of Tourism Policy

The policy statement on the tourism sector (May, 1985) includes the following key goals:

1. To further integrate tourism with agriculture, handicrafts and fisheries.
2. To create and promote Island-wide historical and environmental attractions.
3. To diversify the industry to cater for international, regional and local clientele, as well as high, medium and low income persons.
4. To strive for an appreciation by visitors of the authentic Grenadian culture.
5. Improvement in the Quality of Life. Standards of physical and mental health require adequate recreational opportunities be created for the positive use of leisure time.
6. The Generation of Employment. Employment generation is critical and policies must emphasize growth in activities such as tourism with employment multiplier effects. The capability for foreign exchange earnings is an added bonus.
7. Reduction of Geographic Inequity. The development of tourism attractions through the establishment of a system of parks and protected areas can assist in integrating peripheral areas into the urban centered national growth process, and improving regional/rural economic conditions.

Goals of Forest, Soil and Water Conservation Policy

The state Forest Policy of Grenada (Forest, Soil and Water Conservation Ordinance/Amendment 1984) includes the following key elements:

1. To protect tree cover on such land as required for the prevention of erosion and flooding and the protection of water supplies.

2. To effect the permanent reservation as forest reserves such areas of land as may be required to ensure the continuous supply of forest products.
3. To maintain the level of forest growing stock, to ensure sound silvicultural practices are employed and to direct harvesting such that this growing stock is not reduced.
4. To protect such areas as may be required to provide a natural and undisturbed habitat for flora and fauna of Grenada.
5. To encourage and assist owners and managers of forest, woodlands and plantations whether they be on private or Crown Lands.
6. To create areas within the forest to satisfy needs for recreation within a peaceful natural environment.
7. To encourage the fullest development of the productive forests.
8. To encourage the establishment of appropriate forest industries.
9. To protect the consumer by ensuring well manufactured forest products are supplied in conformity with market demand.
10. To extend educational and training opportunities at the professional, technical and vocational level to forestry personnel.
11. To initiate and conduct forest research necessary to ensure fulfillment of this Forest Policy.

Purpose of National Park and Protected Areas System Policy

The purpose of the park policy statement is to provide a definite course of action for programmes concerned with the protection and use of the country's natural and cultural heritage. It integrates the intent of Government policy in conservation, forestry, land-use, tourism and recreation as it relates

to natural and cultural area management.

This policy provides the basis for the enactment of the legislation necessary for the Government of Grenada to manage units of the system.

GENERAL POLICY AND PRINCIPAL GOALS

The policy of the Government of Grenada will be to protect in perpetuity those areas which represent significant examples of the country's natural and cultural heritage, to encourage public understanding, appreciation and enjoyment of that heritage in ways which leave it unimpaired for future generations, and to guarantee a continual flow of social and economic benefits for the country and its people. Management and development of the protected areas system and the consequent production of goods and services will be conducted in an appropriate manner within the cultural context of Grenada. In the context of national development policy, the goals of the national park policy are:

1. Development of a high quality living environment in a context of effective resource development which whenever possible retains the aesthetic value of the landscape.
2. Contribution to economic welfare and development through the establishment of productive sector links with protected areas, in order to maximize the availability of natural goods and services to the nation.
3. Allocation of lands to optimum use - and in particular to preserve those areas with fragile ecosystems in which fewer development alternatives exist.
4. Development of environmental awareness and appreciation in the general population.

SPECIFIC NATIONAL PARK AND PROTECTED AREAS SYSTEM OBJECTIVES

Areas will be established within the National Park and Protected Areas System to meet one or more of the following objectives:

1. Maintain in a natural or near natural state areas that constitute examples of the country's terrestrial and marine ecosystems, landscapes and geological formations, in order to guarantee the continuity of evolutionary processes and their existence for future generations.

2. Provide and protect natural resources for outdoor recreation needed by the citizens of Grenada.

3. Protect, manage and improve the natural and cultural landscape of the country in order to maintain the visual quality of the environment.

4. Stimulate national and international tourism potential and revenue for the country.

5. Preserve genetic materials as elements of natural communities, minimize the loss of any plant or animal species and maintain biological diversity.

6. Protect and manage fish and wildlife resources in view of their important role in environmental regulation, sport and recreational activities and as producers of protein and other products.

7. Provide area for research, formal and informal education and the monitoring of environmental processes.

8. Protect and improve watersheds and water courses to maintain high standards of quality and quantity; control of erosion, sedimentation and flooding; protect downstream investments that depend on water supply, such as reservoirs and irrigation projects.

9. Produce timber, other forest products, forage and/or marine products for the benefit of the population and to decrease dependency on foreign imports.

10. Protect sites and objects of cultural, historical and archeological heritage as a basis for educational tourism.

11. Stimulate rational use of marginal areas and environmentally sound rural development.



Deforestation on steep slopes adjacent to inland bays can cause sedimentation of the marine waters which can have detrimental effects on the coral reefs.

CATEGORIES OF PROTECTED AREAS

The Government will protect and manage natural and cultural resources in five management categories:

Category National Parks
Purpose

The protection of outstanding natural and scenic areas of national or international importance. The national park should provide recreational, scientific and educational activities.

Criteria for Selection

National parks are relatively large land or water areas containing a complex of ecosystems. They should include the most outstanding natural areas of the country, be under strict Government control and conform to international standards.

Management Objectives

To protect natural resources through a zoning system which will ensure the provision of strict protection in some areas and intensive recreational and educational uses in other areas without disrupting the long range objective of ensuring the area is available to future generations.

Examples

Grand Etang, Levera Pond and Archipelago, and High North National Park.

Category Natural Landmarks

Purpose

To protect natural features of a unique character such as outstanding waterfalls, cave systems, geological features and distinctive landmarks and to ensure that these features do not lose their unique characteristics.

Criteria for Selection

Size is determined by the specific feature and the surrounding area necessary to ensure its protection. The features should be distinctive, and in a near natural state. Generally, these would be small areas rather than complete ecosystems and provide opportunities for recreational activities.

Management Objectives

To provide public access for recreational users but respecting the characteristics of the feature. These uses may be intense provided they do not destroy the basic feature protected.

Examples

Lake Antoine, Marquis Island, and Fossil Beds at Grand Bay.

Category Cultural Landmarks

Purpose

To protect cultural features of a unique character such as old sugar and rum mills, military forts, great estate houses and their surrounding grounds, churches and Amerindian sites.

Criteria for Selection

Size will often be determined by the ownership status and by the specific features. The features should have potential for helping Grenadians and visitors understand the cultural and historical heritage of the Island.

Management Objectives

To provide public access for educational and recreational uses related to the characteristics of the feature. These sites will be developed with the collaboration of the National Trust, the Historical Society and other agencies, and if the areas are privately owned, in conjunction with the owners.

Examples

Fort Frederick, Carib's Leap, and Thiboud-Limlair Estate

Category Protected Seascapes

Purpose

To protect outstanding littoral mangrove and island habitats, beaches and coral reefs which possess special aesthetic and ecological qualities. Life styles which have traditionally utilized marine and terrestrial resources can continue to co-exist. The boundaries of these areas will be set to

include land adjacent to the shorelines and coral reef systems.

Criteria for Selection

The size of the area will depend upon special arrangements with owners, since State land only extends to the high water mark.

Management Objectives

To ensure the ecological integrity and scenic quality of seascapes is maintained for demonstrating the harmonious interactions of man with the sea, while providing opportunities for recreation, tourism, education and research.

Examples

Calivigny Harbour, the North Eastern coastline, and White/ Saline Islands.

Category Multiple Use Management Area

Purpose

To manage natural resources and ecological processes to contribute significantly to the economic needs of the nation. The multiple function of these lands and waters can provide sustained yields of natural products and conserve genetic diversity. Private lands needed for inclusion within the National Park System will be acquired under the provision of Land Acquisition Ordinance which allows for the acquisition of lands for public purposes.

Criteria for Selection

These will be large areas suitable for sustained production of water, wood products, wildlife, forage and/or marine products and for outdoor recreation and education. Ownership of all or most of the land should be by the Government.

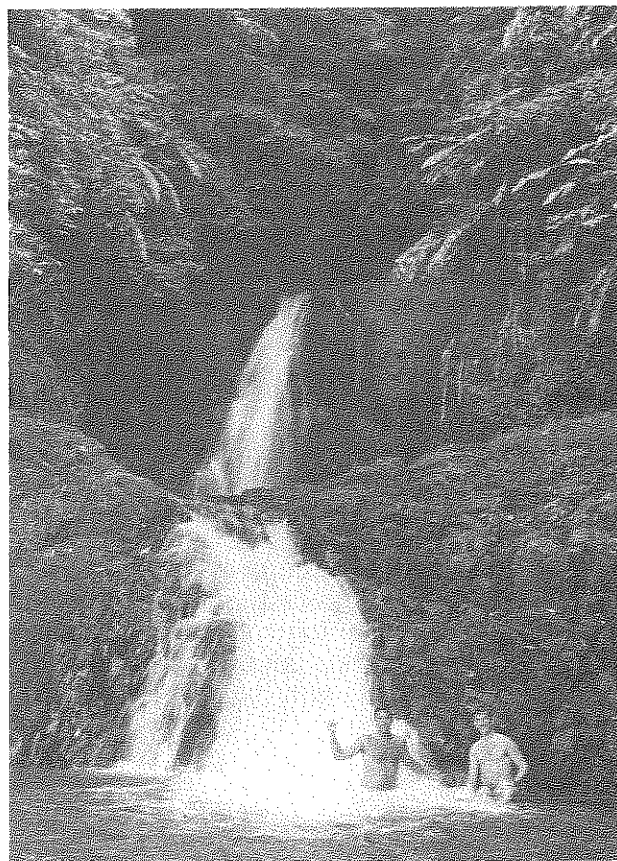
Management Objectives

Sustained production of water, fibre, other

wood products, wildlife, forage and/or marine products and outdoor recreation and education should all be ensured. Conservation of nature will be primarily oriented to the support of economic activities but zones also may be established for nature protection.

Examples

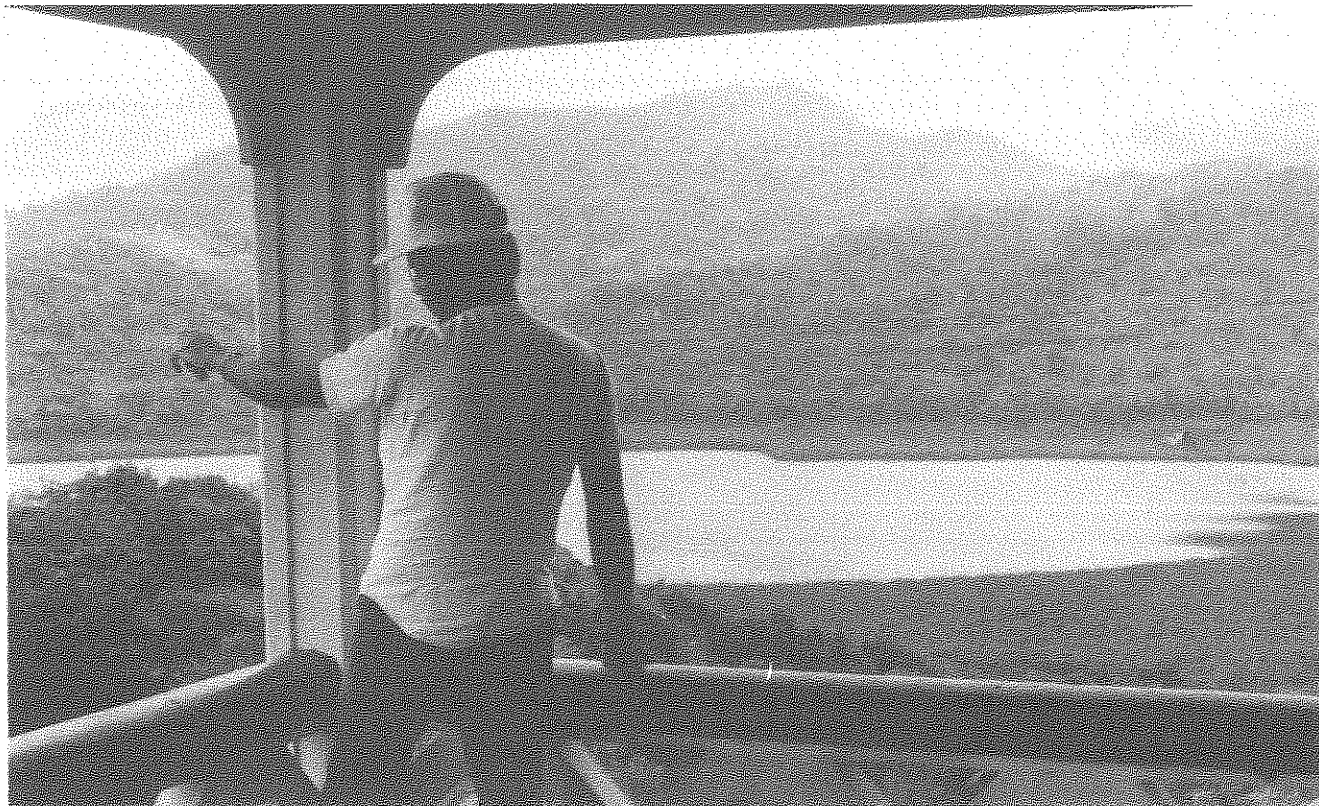
Annandale Watershed and Concord Watershed



The isolated St. Margaret or Seven Sister Falls within the Forest Reserve is an invigorating hike through banana and nutmeg plantations.

FOREST RESERVES

One Forest Reserve, the Grand Etang, exists in Grenada and two areas in Carriacou. These areas will be utilized as is indicated in the Forest, Soil and Water Conservation Act.



The view from the Forest Centre of the Grand Etang is considered one of the most interesting and beautiful in the Caribbean.

It is conceived that certain key watersheds such as the Les Avocats will be managed with input from both forestry and national parks.

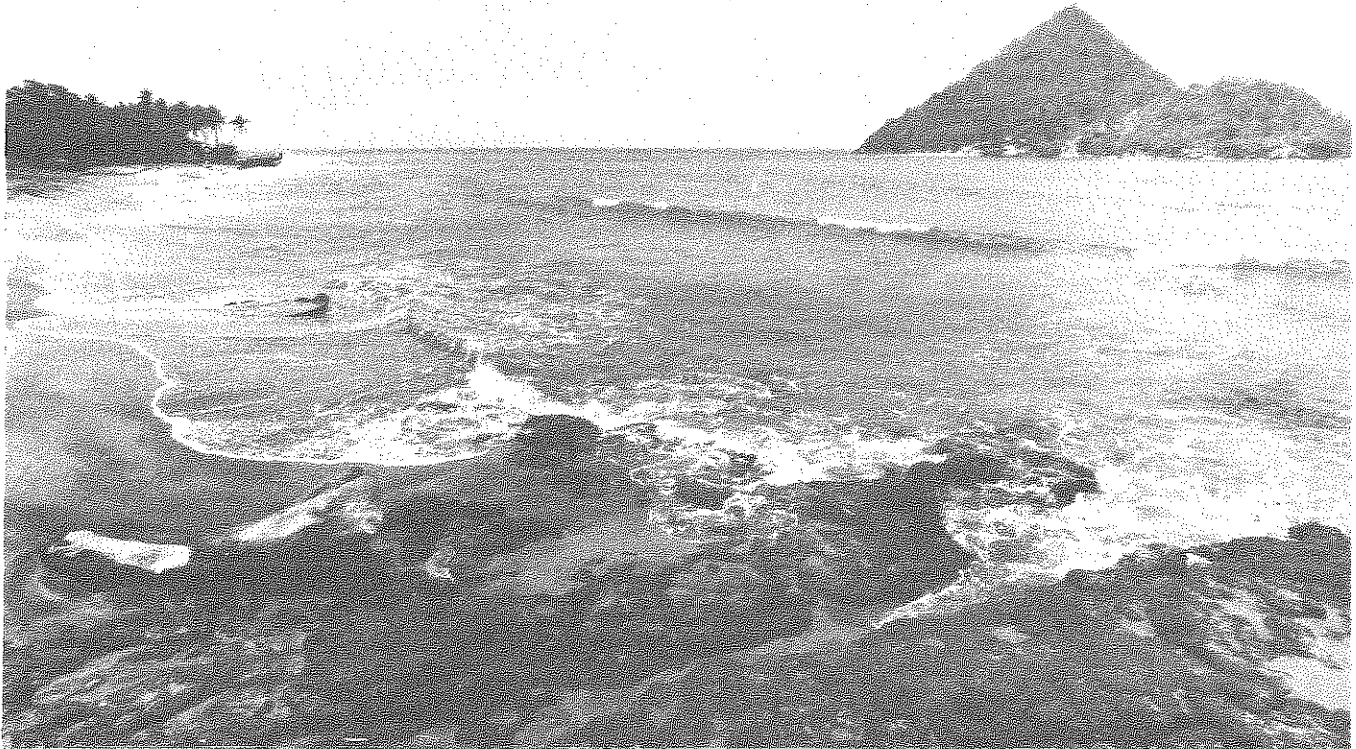
As other watersheds become important in the future, the Forestry and National Parks staff in conjunction with Land and Water Resources and The Central Water Commission will manage the areas to avoid erosion or water pollution within these watersheds. As the overall forestry and protected areas program evolves, new areas may be recommended for Cabinet approval. In the event that private ownership threatens the integrity of a critical watershed area, the Cabinet may opt to purchase the property, as has occurred in the Annandale Watershed. Recreational hunting will be permitted in the forest reserves and multiple-use management areas. The Hunter's Association understands the need for areas where hunting is prohibited to ensure the continuance of biological diversity.

Additional Categories

Government may also consider the possibility of including areas in two categories which form part of international conservation programmes: Biosphere Reserves which are part of the Man and the Biosphere Program (MAB) and World Heritage Sites which are part of the World Heritage Program. UNESCO is the secretariat of both programmes and the latter would require that Grenada become a signatory to the International Convention concerning the Protection of the World Cultural and Natural Heritage. The former would require establishment of a National MAB Committee. In both cases the Country would have to nominate areas it considers appropriate for inclusion in either international program. Figure I describes those categories in more detail.

Non-State Ownership

Regulation of land uses on private lands



With the development of Levera as a National Park, handicraft shops, restaurants, and taxi drivers will receive increased business thereby contributing to their economic well-being.

adjacent to protected areas may be necessary to ensure that actions on these lands are not detrimental to fulfilling the objectives for the units of the system.

Although areas of outstanding national significance, in general, should be the property of the State, areas which are important but do not warrant acquisition for inclusion within the system may be managed by individuals or by private non-profit organizations. In such instances Government may provide financial and technical assistance and share certain costs of development of the area once the manager is willing to undertake the operation and protection of the area and when the planned uses of the area are deemed appropriate. The Hotel Association is an excellent example of a qualified private group with whom relationships of this nature could be shared.

MANAGING THE NATIONAL PARKS AND PROTECTED AREAS SYSTEM

Functions:

The National Park System will be managed to carry out a variety of functions as indicated below. Specific policies for each management category are detailed in Appendix II.

Protection of Natural Resources

The protection of those natural resources which have led to the establishment of each unit within the system will be a primary consideration of management. Factors which could threaten the resource will be analyzed and appropriate protection methods implemented and, when appropriate, measures will be taken to enhance degraded resources.

Outdoor Recreation

The System will be managed to provide opportunities for a wide range of recreational activities. The system is not intended to provide for all of the recreational needs of the Country but primarily those that cannot be met in areas

not containing outstanding natural or cultural resources.

Information, Interpretation and Education

The Areas within the System will be managed to provide visitors with an understanding of the natural and cultural resources in such a way that it enhances their enjoyment and appreciation of the area.

Information relative to the programmes, activities, plans and recreational opportunities of the various areas will be given the widest distribution to ensure that the public, and in particular schools are properly informed of the opportunities available.

Facilities and Services

Areas within the System will provide facilities and services necessary for public access, recreation and understanding of the area. The type and location of the facilities will reflect the resource, management category and expected use and will be undertaken in accordance with the site plan.

Certain facilities and services may be provided by the Government or by private concessionaires. The type and quality of service and maintenance standards will be set by the responsible management agency.

Research

Research concerned with understanding the natural and cultural phenomena and processes, and the protection and use of the areas within the system will be encouraged. Emphasis will be given to undertaking research essential for management purpose but basic research which will expand man's knowledge of the natural environment and cultural resources will be permitted. The nature of the research will vary with the type of area and its objectives and be regulated to ensure the protection of the resources, and safety and enjoyment of the visitors.

Interagency Co-ordination and Collaboration

The National Park Unit will ensure that there is proper co-ordination between the various agencies of Government and others whose activities could affect the resources, or aid in the management of the system.

The National Park unit will be responsible for providing technical information and assessing areas proposed for inclusion within the System. Once included, areas may be excluded from the system only by special law or transferred from one management category to another by direction of Cabinet.

LAND OWNERSHIP

State Ownership

Areas established and managed as part of the National Parks and Protected Areas System shall be the property of the State or managed in coordination with the Government. When lands are formally included within the System all powers of ownership should be transferred to the National Park Unit of the Forestry Department.

A provision should be made to encourage private land owners to deed a portion of their land or the management thereof to the State for protection in perpetuity while receiving special rights to continue living on adjacent parcels, but under strictly established management regimes.

These provisions for strict State ownership or control should apply to all units classified as National Parks and Natural Landmarks and the majority of Cultural Landmarks. In Protected Seascapes and Multiple Use Management Areas most of the land and water should be under Government ownership or strict control in perpetuity. In certain specific cases Cultural Landmarks may remain under private ownership but only if specific covenants with the state establish clear management guidelines.



The National Parks Program hopes to increase environmental awareness and give students a better understanding of natural processes.



SCOPE

The National Parks System Plan includes areas of national, natural, cultural and historical value. Areas which are critical to water quality and supply are also included for protection. Areas which provide important economic and natural services such as beach erosion control, protection of fishing nursery grounds, or productive ecosystems were also selected for inclusion within the system.

METHODOLOGY

The process utilized in recommending areas for inclusion into the National Park and Protected Areas System involved a systematic identification and analysis of those areas which best represent the natural and cultural heritage of the country. The inventory phase of the planning process included field trips, overflights, literature review and extensive interviews with knowledgeable individuals. A matrix was designed analyzing the full range of marine and terrestrial ecological zones, vegetative communities, wildlife, geology and geomorphology, and cultural and historical data. In addition consideration was also given to the education, tourism and scientific potential of proposed areas. Based on this analysis, a series of overlay maps were prepared to help ensure that all areas judged to be important were included within the system. Subsequently this information was correlated with national land-use priorities to minimize conflicts between critical agriculture or forestry areas and activities proposed for the park system. For example, the national land-use capability map identifies lands in classes I - IV as having potential for agriculture or agro-forestry. Combining this information with soils data, Grenada's most productive lands can be isolated. The national parks inventory was done in a similar fashion using the above mentioned criteria in order to determine those areas offering the most important examples of a particular natural or cultural phenomenon. Another area may have been selected due to its outstanding recreation or

education potential. A series of these exercises leads to a completed system of national parks and protected areas providing a range of benefits to the country.

Most of the terrestrial areas proposed are in capability classes V - VIe, on poor soils and on slopes of greater than 30 percent. All mangrove areas are recommended for protection.

LAND CAPABILITY CLASSES *

- I. Level land with deep soil and no factors limiting the use for agriculture.
- II. Land suitable for cultivation with moderate limitations. The risk of erosion is the primary factor limiting development.
- III. Land suitable for cultivation with strong limitations must be cultivated carefully to prevent erosion of the soil.
- IV. Land marginal for cultivation due to extreme danger of erosion. Improved grassland, or tree crops should be established on this land.
- V. Land not suitable for cultivation. Tree crops, food or forest trees should be established on this land.
- VI. Land not suitable for cultivation. Very steeply sloping land that should never be cleared of its natural vegetation.
- VII. Land not suitable for cultivation due to a combination of adverse factors.

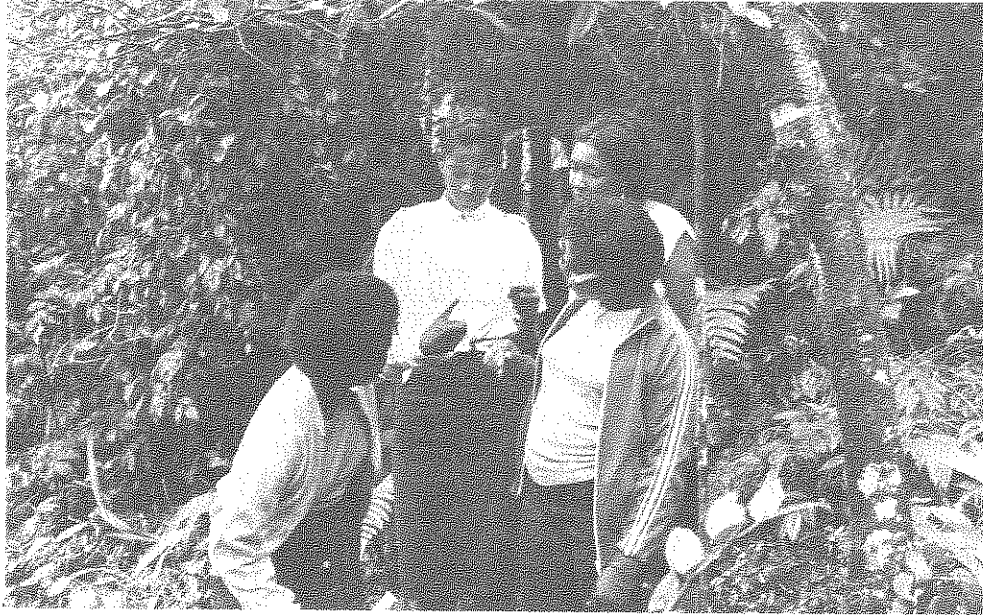
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From Soil and Land-Use Surveys No. 9 Grenada.

CATEGORIES OF PROTECTED AREAS AND THEIR
CORRESPONDING CONSERVATION OBJECTIVES FOR GRENADA

Primary Conservation Objectives	National Park	Natural Landmark	Cultural Landmark	Protected Landscape	Multiple Use Area	Forest Reserve	Biosphere Reserve	World Heritage Site
Maintain sample ecosystem in natural state	1	1		2	2	2	1	1
Maintain ecological diversity and environmental regulation	1	1		2	2	2	1	1
Conserve genetic resources	1	1		2	3	3	1	1
Provide education, research, and environmental monitoring	2	1	1	2	2	2	1	1
Conserve watershed condition	3	3			3	2	3	3
Control erosion, sedimentation; protect downstream investments	3	3			3	2	3	3
Produce protein and animal products from wildlife; permit sport hunting and fishing		2		3	1	1	2	
Provide recreation and tourism services	1	2	2	1	1	3	3	1
Produce timber, forage, or marine products on sustained yield basis				2	1	1	1	
Protect sites and objects of cultural, historical, and archaeological heritage	1	2	2	1	3		2	1
Protect scenic beauty and open space	1	2	2	1	3		2	1
Maintain open options; manage flexibly; permit multiple use				3	3	2	1	1
Stimulate rational, sustainable use of marginal areas and rural development	1	2	2	1	1	1	1	2

NOTE: 1 = Primary objective for management of area and resources.
 2 = Not necessarily primary, but always included as an important objective.
 3 = Included as an objective where applicable and whenever resources and other management objectives permit.



Participants of the first Environment Education Workshop held in the Grand Etang Forest Centre drew up an interpretive plan.



CHAPTER III

INVENTORY AND STATUS OF THE NATURAL AND CULTURAL RESOURCE BASE

GEOMORPHOLOGY*

*Researched by Bruce Johnson, United States Peace Corps Volunteer, Land Use and Water Resources Division.

Geomorphology is the study of the characteristics and evolution of landforms. The study may involve whole physiographic regions, or be confined to individual structures within a small area. In essence, the geomorphologist attempts to answer the question, "How did the land come to be this way?"

In Grenada the answer to that question involves analysis of several variables: parent material (geology), climate, relief, and time, among others. Grenada has basically two physiographic regions: the rugged, high-relief interior, and the relatively low-relief coastal periphery.

The interior of Grenada is dominated by mountain peaks, steep ridges, and deep narrow valleys. Fast flowing streams with high gradients occur in the valley bottoms. Relief tends to be very high, with a 2000 foot drop over 1 mile horizontal distance in some areas. The volcanic geology of the interior is the dominant factor that produced this landscape. Shifting volcanic vents created a somewhat jumbled topography with several major peaks, each having numerous ridges radiating from them. The Mt. St. Catherine area is an excellent example of this phenomenon. The ridgetops, composed mostly of andesite and basalt lavas, have surprisingly retained their narrow tops and steep sides. This is possibly due to the low permeability of the clay soils to water, the principal erosive agent of the rock.

The coastal periphery of Grenada presents a landscape which is much more subdued than the interior. Again, the major factor

appears to be the character of the volcanic center deposits in the area. In contrast to the volcanic centers of the interior, the coastal deposits are dominated by "reworked" volcanic rocks, including fluvial (stream) and mudslide deposits.

Originally, the topography of the coast may have been quite rugged. But fluvial and mass-movement processes tend to reduce relief by removing material from elevated areas and depositing that material in the lowlands. Southern Grenada's surface geology is almost entirely comprised of (lahar) mudslide deposits and fluvially-deposited (reworked) volcanics. The rocks exposed in the Southern Seascape Protected Seashore area are of this type. The entire eastern coast of Grenada is composed of reworked volcanic deposits, which accounts for the gently-rolling topography. The western coast displays a more rugged landscape, owing to the asymmetric eruption to the west, which is a pattern throughout the Windward Islands.

Climate is an important factor in the formation of topography. In Grenada, the small variation in temperature between sea level and the higher elevations is not of great geomorphological importance, but the great difference in rainfall is very significant. An analysis of rainfall indicates that annual rainfall varies directly with elevation. Since water is the principle erosive agent on the Island, the high elevations are eroding at a greater rate than the lowlands. Over time, this disparity in erosion will serve to reduce the relief between the interior and the coastal periphery.

An important manifestation of the weathering process is the formation of soils. Soils form from the same interplay of factors which influence topography, with vegetation becoming a significant variable. As indicated by Vernon (1959), climate is the single most important factor in the distribution of Grenadian soils. Therefore, in the Island's interior the soils are indicative of a high degree of chemical

weathering, consistent with the high rainfall. The soils are generally kaolinitic latosols, meaning a highly leached soil with kaolinite as its principal clay component. The predominance of iron and aluminum oxides in the soil give it a distinctive bright red to orange-yellow color. The latosols have a poor nutrient-storage capacity, are fragile, easily disrupted and must be carefully managed.

GEOLOGIC HISTORY

Reconstructing Grenada's geologic history poses a formidable task for the geologist. Most of the Island is covered by soil and dense vegetation, and rock exposures are often severely weathered. Topographic relief is great, which makes the stratigraphic correlation of rock units even more difficult. Most significantly, the geology of Grenada is complex and presents many rock types of different ages.

Several geologic studies have been conducted in Grenada, dealing with the chemical composition of particular rock types. The precise relationships between various rock units are not well understood, due to vegetative cover and the fact that volcanic centers shifted many times over millions of years. This shifting often resulted in the juxtaposition of rock units of different age, type, and volcanic source, making geologic interpretation difficult. Erosion which occurred during and between periods of active vulcanism further obscures the geologic record.

To date, the most probable chronology of events is presented in a paper by R.J. Arculus (1976), although even the author admits to gaps in the data. The following description of Grenada's geologic history is drawn primarily from the 1976 Arculus study. Table I summarizes the sequence of events, and Table II lists some geologic features by period and where they are represented within Grenada's National Parks System.

The geologic history of Grenada began approximately 38 million years ago in the

upper Eocene Period. At that time, there was only a shallow sea where Grenada now exists. The sediments deposited were composed of sand, silt, mud, and calcareous mud; the rock formed from this process is now known as the Tufton Hall Formation. In between the sediments of the Tufton Hall, geologists found layers containing volcanic minerals and other deposits of volcanic origin. Volcanic activity became more frequent in the Oligocene period (37-26 million years ago). The volcanic activity during and following the deposition of the Tufton Hall formation deformed and uplifted the rock, resulting in the folding and faulting which can be seen just north of Levera Beach.

The oldest of the volcanic rock series are the andesite domes of northern Grenada, which formed in the Miocene Period (26-5 million years ago). These andesite domes (Mt. Alexander, Mt. Rodney, Mt. William) have been estimated by radiometric dating to be 21 million years old. The middle Miocene Period is not well represented in Grenada, but the andesite domes of Levera Hill and Levera (Sugar Loaf) Island represent volcanic activity near the end of Miocene time. Thought to be concurrent with the Levera events were the eruption of the southeast mountain and Mt. Lebanon centers, which recorded the first major shift of eruptive centers to the south.

The Pliocene Period (5-2 million years ago) witnessed the advent of Grenada's most intense volcanism. In the southwest of the island, basaltic lava flows estimated at 3.5 million years old are interlayered with reworked volcanic sediments. The source of the basaltic lava was probably the Mt. Sinai Centre, but the conclusive evidence is buried beneath younger volcanics. Most of the "reworked" deposits in southern Grenada are theorized to be lahar deposits of various ages. A lahar is a massive mudslide of unconsolidated volcanic products from the sides of volcanoes. The massive, in-filling character of lahar deposits is thought to be responsible for the relatively subdued topography of southern Grenada.

In the north of central parts of the Island, major eruptions re-occurred in the Pliocene and continued into the Pleistocene Period. The Island's interior was the scene of intense activity as a series of eruptive centers shifted southward from Mt. Granby towards Mt. Qua Qua, emitting a variety of volcanic products. A source near Mt. Granby emitted pyroclastic products (many of which were later reworked) and a series of basaltic and andesitic lavas. The eruption of basaltic and andesitic lavas continued as the vents shifted southward. The chemical composition of these lavas is geologically important because it displays the cyclical nature of magma composition as eruptions occur over time; there is a repeated transition from basalt to andesite compositions. Some basaltic ash layers near Fedon's Camp indicate that a degree of explosivity characterized the eruptions. The final stages of this activity formed the andesitic dome summits of Fedon's Camp and Mt. Qua Qua, and probably ended with the extrusion of basaltic lava on the western ridges of Mt. Qua Qua.

The Mt. St. Catherine massif represents the youngest major volcanic structure on the Island. Activity at this centre likely began in the Pliocene and continued throughout the Pleistocene. Initially, a vent near the Plaisance/Malagon area extruded basaltic lavas, which were overlain by a series of andesitic and dacitic lava flows. As the vent migrated southward, andesitic and dacitic lavas were deposited to the northwest of the present summit. The Pyroclastic flows to the west of the present summit are the most voluminous deposits of their type on Grenada. The large (1 1/2 Km diameter) crater to the South-east of Mt. St. Catherine was partially filled-in by an andesitic dome which probably concluded the eruptions in the area.

The final stage of volcanic activity involved the formation of explosion craters throughout the Island, most notably at the Lake Antoine, St. George's, and Grand Etang locations. Lake Antoine is a well-preserved crater, and has been described as the best

example of a true "tufaceous ring" on the Island. The carenage of St. George's and the Queen's Park are both believed to be explosion craters, giving the Island its best harbour and best source of scoria gravel. The three closely-spaced explosion craters at Grand Etang are generally thought to be the youngest volcanic structures on the Island, having formed approximately 12,000 years ago.

In recent times, volcanic activity on the Island of Grenada has been virtually non-existent, with the minor exception of some hot springs. Most of these hot springs occur in the Mt. St. Catherine area and emit sulphurous water and vapor. Other springs such as the River Sallee and Peggy's Whim Springs are not sulphurous to any extent.

Just 8 kilometers to the north of Grenada, however, is one of the most active volcanoes in the Lesser Antilles. It is a submarine volcano, 160 meters below sea level, known as "Kick 'em Jenny" for the nearby Island of the same name. It has erupted at least half a dozen times this century, with the last eruption occurring in 1978. It is possible that the volcano may emerge during its next eruption. Scientists in Trinidad are currently monitoring this area for seismic disturbances, which might indicate renewed activity.

NATURAL VEGETATION*

*As adapted from (Beard, 1949)

According to Beard (1949), the existing vegetation in Grenada is a result of land-use history and differences in soil types and rainfall regimes. Grenada is intermediate in age between young St. Vincent and old St. Lucia. The principal peak, Mount St. Catherine (2,757 feet), rises in the northern half of the Island as the centre of a massif surrounded by lesser peaks and ridges. South of this massif is a low col where the Clozier road crosses the Island, and beyond it the land rises again into a long, curving ridge, or system of curving ridges, running first towards the south and then bending to

the east and north-east. From these central mountains the land descends fairly regularly to the sea. There is not strictly a coastal plain, though there are lowlands in the north-east at Levera and in the south-west where a long low peninsula runs out to Point Saline.

Except in the higher parts of the mountains, slopes are not excessively steep. As a result, with the small size of the Island's land mass, large areas have been cleared for agriculture including fruit, cocoa and nutmeg.

In the interior, practically all the land was originally sold out to estates, and cultivation was pushed to the highest practicable limit in most cases, though some owners reserved belts of forest on ridges for protective purposes. The Government began the consolidation of a forest reserve in 1897 and today the Grand Etang Reserve now contains over 3,800 acres. Most of this area has been protected from cutting for over eighty-five years, although Hurricane Janet of September 22, 1955 caused extensive blow-down damage. These areas were subsequently planted to Blue Mahoe, a tree noted for its value in watershed protection.

Slopes on Mount St. Catherine are extremely steep and the central massif is clad only with palm brake. Elfin woodland caps the summit and there is secondary, cut-over rain forest on the lower supporting ridges. A similar condition prevails on the steep mountains of Fedon's Camp and Qua Qua. Owing to the steep slopes and young shallow soil, landslides are very frequent. South of Qua Qua the forest growth is more diverse and includes the last remnant lower montane forests in Grenada. In the sheltered lower elevations, the forest is mature, and comparable to the type of rain forest exemplified in the other Islands. Ascending towards the main ridge forest, stature is progressively reduced, and along the crest, montane thicket predominates.

Overall, Grenada has less vegetative diversity than other Islands in the Lesser Antilles.

The main reason for this is not geographical isolation but rather that the flora was profoundly modified by felling of the valuable timber species during the nineteenth century. Most of the original species are now extinct and have been replaced by second-growth forests which grew into a mature structure by the protection afforded since the establishment of the forest reserve. Physiognomically, the forest can now be said to belong to the rain forest formation, lower montane rain forest, and montane thicket, since structure has reached climax. Floristically the communities are associates and not associations, since they are still below climax rank.

1. Rain Forest and Lower Montane Rain Forest

Beard considers these two formations together since there is very little difference in floristic composition between very tall forest with the structure of rain forest proper, and less tall forest approximating lower montane rain forest in Grenada. There is a very gradual reduction of stature and stratification with increasing exposure, and elevation and only on the ridge tops with growth reduced montane thicket is there any radical change in composition. We have therefore a *Dacryodes-Licania* associates belonging to the montane thicket. The latter is evidently sub-climax to the general *Micropholis-Richeria-Podocarpus* Association of the Islands, and the former, presumably, to both the *Dacryodes-Sloanea* and *Licania-Oxythece* Associations.

Beard illustrated a profile in the Grand Etang Reserve, at the 1400 feet level across the slope at a point where the line ran practically level. The strip is roughly at right angles to the prevailing wind. Dominant trees reach 100-110 feet in height and form a closed canopy. All of them on the strip were *Dacryodes excelsa* except for one individual *Maytenus grenadensis*. Most

of the smaller trees, which fell roughly into two stories, between 40-80 and 15-30 ft, were *Licania ternatensis*. The structure agrees very well with that shown by measured profiles in rain forest of Dominica and St. Kitts. The Grenada sample is somewhat denser and shows no sign of wind damage.

The Dominants are (Beard, 1949):

<i>Dacryodes excelsa</i>	(Gommier)
<i>Slonea caribaea</i>	(Chataignier grandes feuilles)
<i>Micropholis chrysophylloides</i>	(Bois)
<i>Simarouba amara</i>	(Marouba)
<i>Oxythece pallida</i>	(Balata laite)
<i>Ficus spp.</i>	(Figuier)
<i>Slonea truncata</i>	(Chataignier petites feuilles)

Species almost never attaining the canopy and ranking as sub-dominants were:

<i>Licania ternatensis</i>	(Bois gris)
<i>Euterpe sp.</i>	(Mountain Cabbage Palm)
<i>Guatteria caribaea</i>	(Mahot)
<i>Maytenus grenadensis</i>	(Bois agouti)
<i>Richeria grandis</i>	(Bois bande)
<i>Byrsonima martinicensis</i>	(Mauricif)
<i>Hex sideroxyloides</i>	(Caca rat)

Species confined to the lowest story were:

<i>Cassipourea elliptica</i>	(Bois d'ail)
<i>Myrtaceae spp.</i>	(Goyavier)
<i>Meliosma herbertii</i>	(Grosse gram)
<i>Guarea macrophylla</i>	(Bois rouge)
<i>Ocotea floribunda</i>	(Laurier petites feuilles)
<i>Euterpe globosa</i>	(Mountain Palm)
<i>Sapotaceae sp.</i>	(Sapotere)
<i>Pithecellobium jupunba</i>	

Beard indicates that the forests of Grenada differ from those of the other Islands in two main respects - paucity of species and

altered relative numbers of the species present. Grenada is at an extremity of the arc of the windwards and is 70 miles from St. Vincent; the Grenadines in between may never have stood high enough to harbour a rain forest flora and so are not associated with assisting the migration of these species.

From the point of view of relative numbers of species in composition, the most surprising thing is the complete absence of stocking resembling the *Licania-Oxythece* Association, although the forest is on Red Earth Lateritic oxisols and in its 'low phase' agrees structurally with lower montane rain forest. Both *Licania* and *Oxythece* are present in Grenada, but are never the principal dominants. Beard suggests the probability that we must blame man's exploitation of timber in the past for such floristic differences that exist. *Manilkara bidentata*, which is one of the most valuable of all the timbers, is not found in the reserve at all. *Hicronyma caribaea* and *Ormosia monosperma* are found only in secondary growth. *Meliosma herbertii*, *Simarouba amara*, *Ocotea floribunda*, *Oxythece pallida*, *Pouteria multiflora*, and *Phoebe clongata* are rare to very rare and are present usually as young specimens only. All these are the valuable timber species which were presumably cut out during the nineteenth century. Local information indicates that this was the case.

2. Montane Thicket

Montane thicket in Grenada covers the summit of the main watershed from Mount Qua Qua south towards Mount Sinai and lesser ridge tops in the area. *Micropholis chrysophylloides* is dominant and forms 40 percent of the crop. Nearly all the big trees are of this species, some of them up to 6 feet in girth. Associated species are principally 'goyavier' (group of *Myrtaceae* sp.) 19 per cent., *Licania ternatensis* 11 per cent., *Euterpe globosa* 9 per cent., *Dacryodes excelsa* 5 per cent., and *Richeria grandis* 4 per cent. Less commonly *Euterpe* sp., *Rapanea guianensis*, *Oxythece pallida*, and *Ilex sideroxyloides* are found. Composition

has probably been affected by fellings in the past as is the case of the rain forest. There is virtually no shrub layer at all. Epiphytes seem to be confined to small orchids and ferns and while there are few climbers, the forest is extremely mossy. Ground vegetation is knee-high and thick beneath typical montane thicket, consisting of seedlings, ferns, and razor grass *Scleria*. In the profile lee of the ridge, the ground vegetation increases to waist high and is a tangled mass of razor grass, ferns, *Ischnosiphon arouma*, seedlings and young palms.

3. Elfin Woodland and Palm Brake

Beard (1949) considered Elfin Woodland and Palm Brake together. They exist for the most part in rather intimate relationship. The steep slopes of St. Catherine and the windward sides of Qua Qua and Fedon's Camp are covered with a patchy growth seamed with the traces of landslides, running up and down the slope. One may see the bare earth of fresh slides, or recent ones covered with moss which appears to stabilize the soil, the next stage being a thicket of small tree ferns *Cyathea* or balisier *Heliconia bihai*. Other landslides may be colonized by *Euterpe globosa*, forming a patch of palm brake. All these successional stages are set in a matrix of Elfin Woodland, a repressed growth 10 feet in height, gnarled, mossy, and containing the typical elfin species: *Chorizanthe purpureus* var., *Weigeltia antillana*, *Didymopanax attenuatum*, *Ilex sideroxyloides*, *Rondeletia stereocarpa*, *Rapanea ferruginea* and *R. guianensis*, *Myrcia berberis*, *Byrsonima martinicensis*, *Stylogyne lateriflora*, *Besleria lutea*, and a few *Euterpe globosa*. The palms are stunted and the tips of the leaves appear scorched.

Most vegetation is covered with moss, epiphytes and climbers. At the summits' of the mountains pure stands of Elfin Woodland are found. On the very top of St. Catherine and Fedon's Camp growth is reduced to waist height.

On many of the leeward slopes of the southern mountains Fedon's camp, Qua Qua, South-east Mountain, Montane Thicket is replaced by clumps or groves of *Euterpe*, sometimes 60-70 feet high and far overtopping the stunted forest. This is evidently a sub-climax type, due to storm damage.

4. Secondary Tropical Rain Forest

There is a good deal of secondary growth on land formerly cut over by shifting cultivators along the Mount Sinai ridge and in the Mount Sinai water catchment. Such growth varies from a dense crop of herbaceous *Heliconia bihai* to young forest, according to the stage of succession. The subsequent tree pioneers are, most conspicuously, *Nectandra antillana* and *Guarea macrophylla*, the latter here appearing in an unusual role. Other species include *Sapium caribaeum*, *Hicronyma caribaea*, *Euterpe globosa*, *Cecropia peltata*, *Cordia sulcata*, *Ocotea martinicensis*, *Ochroma pyramidale*, *Inga edulis*, and *Miconia guianensis*. In the lower part of the Mount Sinai catchment conspicuous pioneer species include *Byrsonima spicata* and *Manilkara bidentata*.

5. Dry scrub Woodlands

Beard (1949) states that the only example of fairly intact woodland of the Tropical moist forest belt seems to be that crowning Morne Delice, an isolated, high and conical hill 900 feet in height, 2 miles inland from the south coast. Tree growth has evidently been allowed to remain due to unsuitability of the terrain for cultivation, but has been subject to frequent fellings. At the bottom of the hill there are young secondary thickets of mahogany *Swietenia mahagoni*, white cedar *Tabebuia pallida*, *Guettarda scabra*, and other pioneers.

Most other examples of tropical moist forest consist principally of young *Swietenia mahagoni*, an invasive species, or of low bush with *Acrocomis* palms. Nearer to the

coast in the dry belt only very impoverished growth remains. At best there are woodlands 30-40 feet high on rocky hill-tops, containing mostly the naked indian *Bursera simaruba*, with a few individuals of *Lonchocarpus latifolius*, *L. benthamianus*, *Albizia caribaea*, *Citharexylum spinosum*, *Pisonia fragrans*, *Tabebuia pallida*, *Chlorophora tinctoria*, *Genipa americana*, and *Cordia collococca*. Undershrubs include *Bauhinia unguis-cati*, *Pithecellobium unguis-cati*, *Tecoma stans*, *Amyris elemifera*, *Randis mitis*, *Jacquinia barbasco*, and *Annona squamosa*. When severely degraded by cutting on eroded slopes, the tropical moist forest may be replaced by thorn bush of *Haematoxylum campechianum*. Poor grazing land is also colonized by open thorn bush with *Acacia nilotica*, *A. farnesiana*, *Haematoxylum*, and various native shrubs including prickly pears *Opuntia dillenii* and columnar cacti *Cephalocereus*. Most of the Point Saline peninsula is covered by alternations and mixtures of these same types (Beard 1949).

6. Littoral Woodland

Very little remains of this formation in Grenada. At Levera in the north-east the littoral hedge is formed of *Conocarpus erectus*, *Jacquinia barbasco*, and white cedar *Tabebuia pallida* (in its monophyllous form). The woodland behind contains also sea grape *Coccolobis uvifera*, mapou *Pisonia fragrans*, manchineel *Hippomane mancinella*, *Erithalis fruticosa*, *Bourreria succulenta*, *Pithecellobium unguis-cati*, and *Rheedia lateriflora*. On the Point Saline peninsula some sandy raised beaches carry pure groves of *Hippomane mancinella* up to 50 feet in height.

7. Swamp

There are some small mangrove swamps, chiefly at Levera Pond in the north-east and at the head of the various deep inlets at the south coast. These contain the usual red mangrove *Rhizophora*, black mangrove *Avicennia*, white mangrove *Laguncularia*, and button mangrove *Conocarpus*. In all cases they are recommended for protection. *

WILDLIFE*

* As adopted from "A Natural History of Grenada," J.R. Groom 1968.

Grenada is the last remaining portion of the Grenada Bank - a volcanic entity, with sheer submarine cliffs stretching from the Island of Bequia in the North to Reindeer Shoal in the south. Deep water separates Grenada from all other major Islands (St. Vincent, Barbados, Trinidad and Tobago), which gives added evidence that Grenada is a purely volcanic Island which rose from the sea never having had a land bridge between any other land mass other than the Grenadines. Grenada and the Grenadine Islands may have been an "Oceanic Island" since during the Pleistocene period (Glacial Epoch of one million years ago) when the sea level is estimated to have been between 50 and 150 fathoms lower, plants and animals may have been able to spread throughout the Grenada Bank.

The Oceanic Islands such as Grenada (Volcanic) or Barbados (uplifted coral) will present a relatively poor biological diversity compared to Trinidad and Tobago, which were at one time connected to the biologically rich South American Continent. In Grenada, animal and plant migration would have only occurred by flight, winds, or as part of a large vegetative mat which would form in the Orinoco River, and float haphazardly to Grenada. Interestingly, the majority of winged insects and birds are of North American origin indicating the Island is on the Northern Antillean migratory route.

INVERTEBRATES: Groom, 1970, indicates that no endemic invertebrates have been described in Grenada with the possible exception of the weevil *Diaprepes*. The centipede whose bite causes a swelling, is the only dangerous animal per se in Grenada. Neither the parasol ant *Acromyrmex octospinosus*, or the water snail *Australorbis glaberrimus*, the secondary host of *S. mansoni*

which causes Shistosomiasis and which is prevalent in the freshwater streams and ponds of St. Lucia, occur in Grenada.

VERTEBRATES: Island isolation has given Grenada a much less spectacular flora and fauna than Trinidad and Tobago, for example, because of the difficulty the animals have in arriving to Grenada. Furthermore, almost all of the forests of Grenada below 2,000 feet have been altered for cocoa, nutmeg, or banana production. Some examples of South American fauna such as ground lizards *Ameiva* and skinks *Mabuya* are found in Grenada. Groom, indicates that Grenada appears to have no Greater Antillean types of indigenous amphibians or reptiles, but only South American stocks which arrive here on floating mats of vegetation. Myers, 1937 again supported the Oceanic Island theory by stating, "The most striking feature of the fresh water fish fauna of the West Indies is the complete absence of members of the primary division of fresh water fishes, in particular the *Ostariophysii*, which swarm in all the waters of North, Central and South America".

AMPHIBIANS: In general, Groom, 1964 states "Amphibians are absent on Oceanic Islands, for their eggs and tadpoles require fresh water and their skins are totally allergic to salt."

Present are: The giant toad *Bufo marinus*, the piping frog *Eleutherodactylus* and the highland piping frog *E. johnstonei* which is confined to the remnant forests of the Grand Etang.

Garman's woodland frog *Leptodactylus wagneri* is found which is also characteristic of the primeval forest of the Grand Etang Forests.

The giant woodland frog *Leptodactylus fallax* an edible frog, was introduced but apparently did not survive.

REPTILES: There is one island endemic, *Typhlops tasymicris*, which is known only from St. David Parish, Grenada (Schwartz

and Thomas 1975); no information is available on its ecology or status.

The house gecko - *Thecadactylus rapicauda* is an object of superstition.

The spinous gecko *Hemidactylus mabouya* was introduced from Africa.

The common anole or wall lizard *Anolis aeneus*, is found from Trinidad to St. Vincent. The crested or tree lizard (*Anolis richardi*) is found only from Tobago to Grenada and some Grenadines.

Iguana iguana is becoming increasingly more rare due to hunting and its reputation as a culinary delicacy.

Garman's ground lizard - *Ameiva ameiva* or zaggada, a handsome blue colored lizard, (male) is now found only in Grenada and the Grenadines. It is a sun loving lizard and was almost brought to extinction by the mongoose.

Allen's Ground Lizard - *Bachia heteropus alleni*, is found throughout the Grenadines. The South Antillean slippery back lizard - *Mabuya mabouya* was thought to have been extinct, but it appears that its numbers are increasing.

OPHIDIA SNAKES

The following snakes, none of which are venomous, are found in Grenada.

The white headed worm snake *Leptotyphlops margaritae*.

The tree boa *Corallus enydris cookii*.

Boddaerts's tree snake *Mastigodryas bruesti* Cribo *Clelia clelia* a powerful constrictor, feared locally for it's strength, is also an excellent rodent exterminator.

Moon Snake *Pseudoboa neuwidii*.

CHELONIIDAE- Turtles

Sea turtles nest on the beaches on the Windward side of Grenada and Carriacou. The females crawl up the beaches and lay their eggs in the dry sand of the spray zone.

Green turtle -*Chelonia mydas* - are heavily chopped as they come to the beaches to lay up to 600 eggs in a season.

Hawksbill turtle - *Eretmochelys imbricata* is carnivorous, and like the loggerhead feeds on shellfish and rock encrusting marine animals.

Loggerhead turtle - *Caretta caretta*.

Ridley turtle - *Lepidochelys olivacea*.

DERMOCHELYIDAE

Leatherback turtle - *Dermochelys coriacea* is the largest of the sea turtles, weighing up to 500 kilograms.

Testudinidae Tortoise - The morocoy or red legged tortoise - *Geochelone carbonaria* is thought to have been indigenous to Grenada and the Grenadines but was hunted to extinction. It has since been re-introduced.

In exercise of the powers conferred by Section 40 (r) of the Grenada Fisheries Act No. 15 of 1986, the Minister declared on the 6th May, 1987 the following closed seasons for the harvesting of Turtles, Lobsters and Oysters.

Turtles: 1st May to 30th September
Lobsters: 1st May to 30th September
Oysters: 1st May to 30th September

BIRDS

Birds - 150 species of birds have been identified in Grenada and the Grenadines. (See Groom, 1970).

The avifauna is primarily tropical North American. The avifauna, as compared to Trinidad, is remarkably different considering the islands are only 100 miles apart. The absence of a parrot (*amazonas*) in Grenada is interesting, considering Islands to the north such as St. Vincent, St. Lucia and Dominica all have their own endemic parrot.

Parrots were recorded in the 1600's by Dr. Tertre (1667-1671) and Labat (1693-1705) in FR. Devas book "The History". Groom, postulates that these may have been driven to extinction by the aggressive introduced African mona monkey. These monkeys would be largely responsible for predation of the eggs in the parrots nests.

Ornithologists attribute the peculiar distribution of birds to the hurricane frequency. Since some species are noted for the first time after a hurricane and others may never be seen again.

In the "Protection of Birds and the other Wild Life Ordinance, 1956" Chapter 56 of the revised laws of Grenada, p.347, all wild birds and their eggs are given absolute protection throughout the year, with the exception of 19 species for which there is an open season from September to February. Ducks, waders, waterfowls, pigeon and doves may be hunted, and *Buteo* and *Falco peregrinus* may be legally shot in defence if they attack chickens.

Three species of birds are listed as endangered species by the IUCN Red Data Book. These are:- *Chondrohierax uncinatus murus*, Grenada hookbilled kite; *Leptitilia wellsi*, Grenada Dove; and *Empidonax euleri johnstone*, Euler's fly catcher.

There is one endemic species, the Grenada dove *Leptotila wellsi*, which is currently treated by ICBP (1987) as conspecific with the grey-fronted dove *L. rufaxilla*. There is an account of the species in King (1978-1979), who classes it as indeterminate. The Grenada dove is thought to be very rare and its range is limited to xerophytic scrublands in the southwestern coast of Grenada.

There are no estimates available of population size. The reasons for the rarity of this species are unclear: it is possible that the population has been low throughout this century, or that it has been reduced by competition with one or more of the other species of dove that occur in the same habitat (King 1978-1979).

The following species are endemic to the Lesser Antilles (distributions from ICBP (1987): Grenada flycatcher *Myiarchus nugator* (Grenada, Grenadines and St. Vincent); scaly-breasted thrasher *Margarops fuscus* (Saba, St. Eustatius and Barbuda south to Grenada and Barbados; possibly extinct on Grenada and Barbuda); Lesser Antillean bullfinch *Loxigilla noctis* (Virgin Islands, and Lesser Antilles from Anguilla and Saba south to Grenada and Barbados); Lesser Antillean tanager *Tangara cucullata* (St. Vincent and Grenada).

Information on seabirds is poor. Halewyn and Norton (1974) list the following three species as possible breeders: Audubon's shearwater *Puffinus l. herminieri*, laughing gull *Larus atricilla*, and roseate tern *Sterna dougallii*.

REGION WIDE ENDANGERED SPECIES FOUND IN GRENADA

- *Chelonia mydas*, green turtle (1,2)
- *Eretmochelys imbricata*, hawksbill turtle (1,2)
- *Dermochelys coriacea*, leatherback turtle (1,2)
- *Falco peregrinus tundrius*, tundra peregrine falcon (2)
- *Pallinurus sp.*, spiny lobster.
- *Strombus gigas*, queen conch.

SOURCES

1. Lazell, 1980
2. IUCN Red Book

MAMMALIA - MARSUPIALIA

Marmosa robinsoni - Chapman's murine

opossum, mouse opossum or manicou is strictly a nocturnal animal which uses its prehensile tail for climbing and transporting bedding material.

Didelphis marsupialis insularis - large opossum or manicou is a common omnivorous animal which may prey upon poultry and is hunted for its meat. This species may have been introduced by Amerindians while making journeys in their perogues (Groom, 1970).

EDENTATA

Dasyurus novemcinctus hoplites. Nine banded armadillo or tatou. This species is confined to forested areas, and is under heavy pressure from hunting.

CHIROPTERA - Bats

There are eleven different species of bats, with feeding habits ranging from insects and fish to nectar and fruits. The vampire bat is absent.

RODENTIA

Dasyprocta liporina - agouti - This agouti is extinct on the Island due to overhunting and the aggressive mongoose. Hurricane "Janet" in 1955 may have given the final push to extinction. Naturalists of Grenada would like to see the agouti reintroduced (Beresford Wilcox, Pers. Comm.)

CARNIVORA

Herpestes auropunctatus - The burmese mongoose was introduced from Jamaica about 1870 to control rats in the cane belt. Now it is primarily destructive to poultry, wild ground nesting birds, and lizards. The mongoose is the only proven vector of paralytic rabies in Grenada. (Groom, 1970)

PRIMATES

Cercopithecus mona - The African mona monkey was introduced from West Africa during the slave trade period. It may be seen quite readily in Grand Etang and St.

Catherine Upper Montane Forests.

They are very dangerous and destructive to the local fauna. The hurricane of 1955 reduced their numbers, but their populations have reached new proportions with the limited use of firearms for hunting during recent years.

ENDEMICISM

"Grenada is such a geologically recent volcanic Island, that it is remarkable it should have some five biological items peculiar to itself: A Dove *Leptotilla wellsi* regularly recorded, but rare, a sub species of snake, a weevil, the mountain cabbage palm *Oreodoxa oleracea* and perhaps one of the Grand Etang Ferns *Danaea spp.*" (Groom 1970)

On March 26, 1928 Ordinance Cap: 245 -1934 Revision No.29 of 1956 stated, "This Ordinance establishes the Grand Etang Forest Reserve as a Sanctuary for the Wild Animals and Birds of the Colony, and to make special temporary provision for the protection of the agouti, armadillo, and certain snakes." The short title of the Ordinance may be cited as the "Wild Animals and Birds (Sanctuary) Ordinance." It essentially establishes the Grand Etang Forest Reserve as a sanctuary for wild animals and birds.

The Schedule (section 5 (2)) protects the following snakes:

Leptotyphlops margaritae - white headed worm snake

Corallus enydris - serpent - brown tree boa.

Mastigodryas bruesi - Booddaert's tree snake

Liophis melanotus - Shaw's racer

Clelia clelia - black cribo

Pseudoboa neuwiedi - Neuweid's moon snake

This act seems to have expired at the end of 1962, as a result, no protection will exist for wildlife until Cabinet approves the National Parks and Protected Areas Program.

BRIEF HISTORY OF GRENADA

The protected areas program includes cultural landmarks, entities which are sometimes managed by the Tourist Board, National Trust or Historical Society in other countries. Significant input will be received from these groups, but it was recommended that the National Parks Division manage these resources. The following brief history mentions how the artifacts and other cultural features portray the fascinating history of Grenada.

The migration of South American Indians from their homeland brought the first inhabitants to the Islands. There were two sets of Amerindians who reached the Island - the Arawaks and Caribs. The Caribs are believed to be fierce and warlike, while the Arawaks were peaceful and loving and highly artistic. It has been written that the Arawaks were harassed by the Caribs which hastened their disappearance. It is also believed that the Caribs made concubines of the Arawak women and killed the men. These people were primarily hunters and gatherers and therefore did not affect the natural vegetation. For over 100 years after the sighting of the Island by Christopher Columbus on his third voyage, the Carib Indians were left undisturbed. In 1609 a company of London merchants attempted to establish a settlement but were compelled to withdraw as a result of the hostility of the native Indians.

Interest in the Island developed by both the English and French in the early 17th century. However, it was not until 1638, that a frenchman named Du Poincy attempted to land. This again was unsuccessful and the natives managed to secure the island from further attempts at settlement for twelve years.

The French successfully settled the Island in 1650 despite the usual native hostility. While it was discovered that the Indians called the Island Camahogne, the English named it Conception.

One year later, the Caribs realized the danger they had exposed themselves to and revolted. By then the French had already established their settlement and called for reinforcement from the French Colony of Martinique. The Caribs retreated to a precipitous hill in the north of the Island where they sought refuge. After a great search, the French discovered their refuge and took them by surprise. Most of the Carib Indians leaped into the sea below committing suicide.

Few elements of Amerindian culture survive today. These include words of Amerindian origin, some pottery and other remains found at the museum and petroglyphs in the Mt. Rich area. The Leapers Hill and town of Sauteurs got its name from the tragic event that brought the Indian occupation to an end.

The early French settlers established plantations of indigo, cotton and tobacco. At the beginning of the eighteenth Century, indigo seems to have been the main crop. It is recorded that in 1700 there were fifty-two indigo plantations on the Island. In 1702 sugar cane was introduced from South America and cane cultivation gradually took over from indigo in the early 18th century. Sugar cane cultivation necessitated the introduction of cheap labour into the country and therefore, the slave trade was developed. Africans, East Indian indentures, Portuguese, Chinese and other European bondsmen were introduced to work the plantations for the French. Until the abolition of slavery in 1834, sugar cane was by far the most important crop cultivated on almost all low lying land in the country. Cocoa was introduced to the island in 1714.

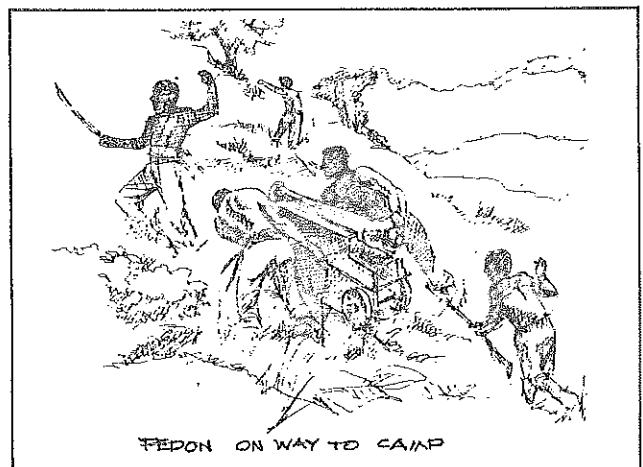
In 1763 the British secured the Island by the Treaty of Versailles of Paris. Grenada was surrendered to the British at Fort Royal (Fort George). It is important to note that every military handover in Grenada's history was done at this Fort, and every time the island changed hands, its name was changed also. Even the March 13th, 1979 Revolution saw a change of name from Fort George to Fort Rupert. This was subsequently changed

back to Fort George after the intervention of American forces in October 1983.

The French temporarily regained Grenada in 1779 during the American war of independence. Four years later, the Island was handed back to the British by the eighth Article of the Treaty of Versailles.

There was always discord among the British and French Colonists on the Island. This caused a major uprising by the French planters against the British Colonist in 1795. In 1789, the French Revolution broke out under the watchwords of Liberty, Equality and Fraternity. Victor Hughes was the agent of the Revolution in the Caribbean with Headquarters in Guadaloupe.

Julien Fedon, a mulatto of French origin who owned the Belvedere estate, which was then the largest estate in Grenada, was in total support of Victor Hughes. In 1795 confusion broke out between the French planters and British colonist. On the night of March 2nd the French took to "looting, fighting and even seizing British citizens". Fedon joined by slaves and "Free Coloured" took possession of all the Island except St. George's. The rebels killed forty eight (48) of the fifty two (52) British citizens on the Island. In 1796 the British managed to reinforce their contingents with officers from Trinidad. They eventually captured the final strong hold of the French, which was the Fedon's Camp located at one of the flat topped peaks in the central mountain range.



After emancipation the labourers were no longer willing to work as regularly on the estates and a severe economic depression followed. The planters also had to compete on the European market with the sugar still produced in the Spanish colonies by slave labour. An attempt was made to introduce indentured labour but that also was unsuccessful. Much of Grenada was deforested for conversion to sugar, and thereafter extensive deforestation continued in order to fuel the rum distilleries. Gradually, sugar production was replaced by cocoa which demanded less labour per acre than sugar. Cocoa at that time drew a good price on the European market. The emancipated slaves and indentured labourers took readily to these crops; a quantity of land could be easily had in the interior and

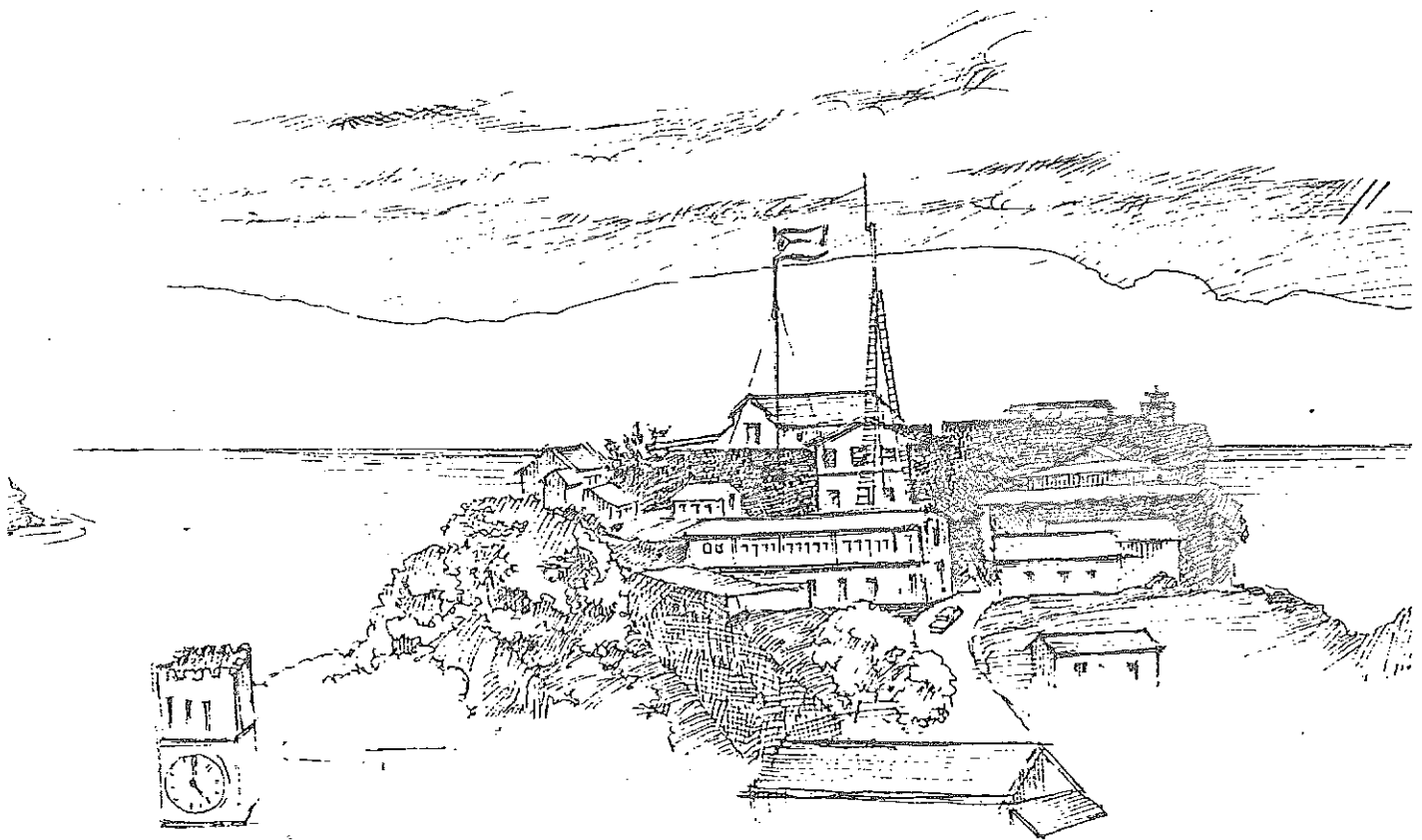
the cultivation of cocoa offered an independent existence and reasonable profits for a minimum of labour. This led to the clearing of a large part of the remaining upland natural rainforest.

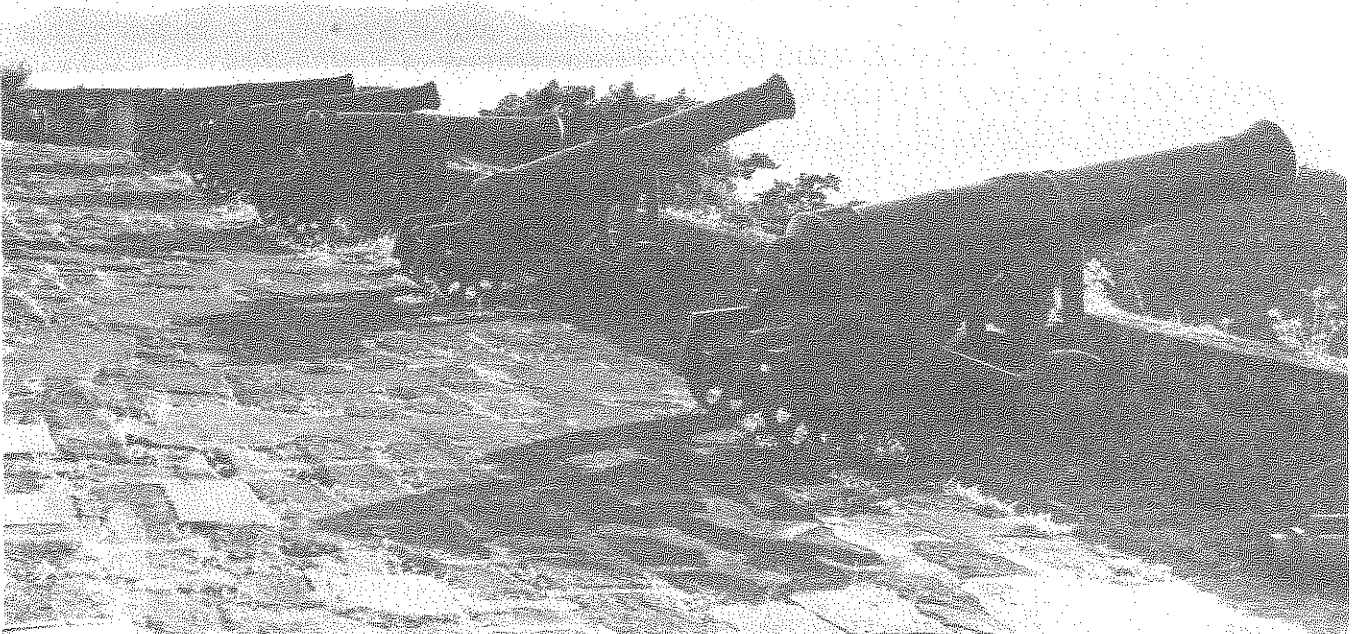
Nutmeg was first introduced into Grenada in 1843, however, it took considerable time for the crop to become a significant export.

After many years of trial the crop became well established.

From the beginning of this Century, tree crops have been the predominant form of agriculture and are of considerable importance to the Island's economy. It was only after the 1955 hurricane that banana became an important crop.

Fort George built in 1706 by the French.





Fort George was built in 1706 by the French. More recently the Fort again became important in the history of Grenada when Maurice Bishop and part of his cabinet were assassinated by a split faction in the People's Revolutionary Government.

CARRIACOU AND THE GRENADINES

Geologic History

The Grenadine Islands and Carriacou represent the exposed summits of peaks on a single narrow bank of submerged volcanic mountains. The Island of Grenada is separated from Carriacou by a channel 600 feet deep.

The Grenadine Islands came into existence in the late Oligocene period, sank or eroded away during the Pliocene and were completely submerged during the Pleistocene period. Since that time, a regional uplifting of the sea floor has raised the Islands above sea level (Howard, 1950).

The diversity of the geological formation of the Grenadines is fascinating. Bequia is characterized by pyroclastic rocks preponderant over massive. Some islands have red and white clays due to laterization and kaolinization of the volcanic andesites in situ. Other islands are weathered rugged volcanic rocks and agglomerates.

Carriacou, an Island of 34 square kilometers has been studied by geologists since the 19th century. The most recent studies have indicated fossiliferous limestone formation ranging in age from upper Eocene to Pleistocene.

The Island can be divided into two zones:

- (i) The Fossiliferous limestone area which is mainly of the miocene age with outcroppings in the eastern part. This non-volcanic formation is characterized by continuous stratifications of calcareous, clastic and volcanic lithofacies; and
- (ii) The volcanic area which covers about two thirds of the Island. This section consists of lava flows, lava domes and volcanoclastic products ranging in age from Miocene to the Pliocene (Briden *et al.*, 1979).

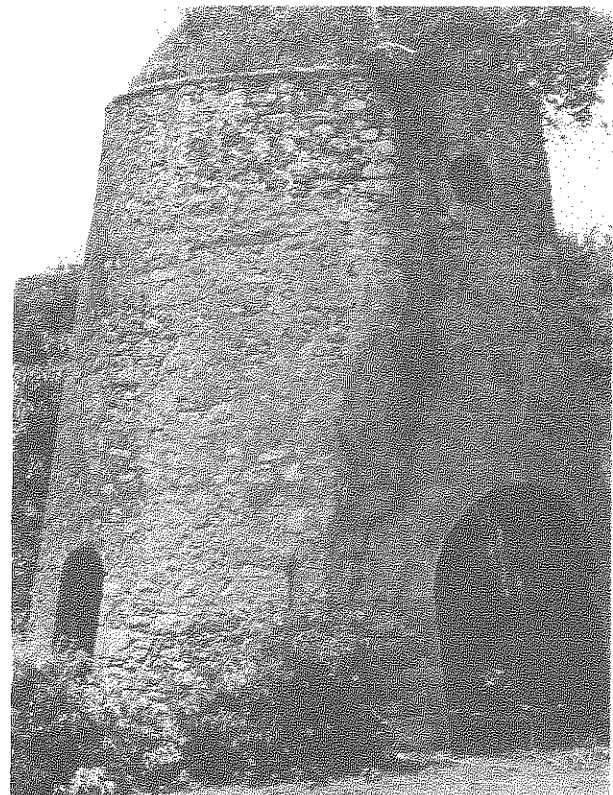
Climate

The climate of the Grenadines is a relatively uniform one characterized by a northeast breeze which prevails most of the year. The

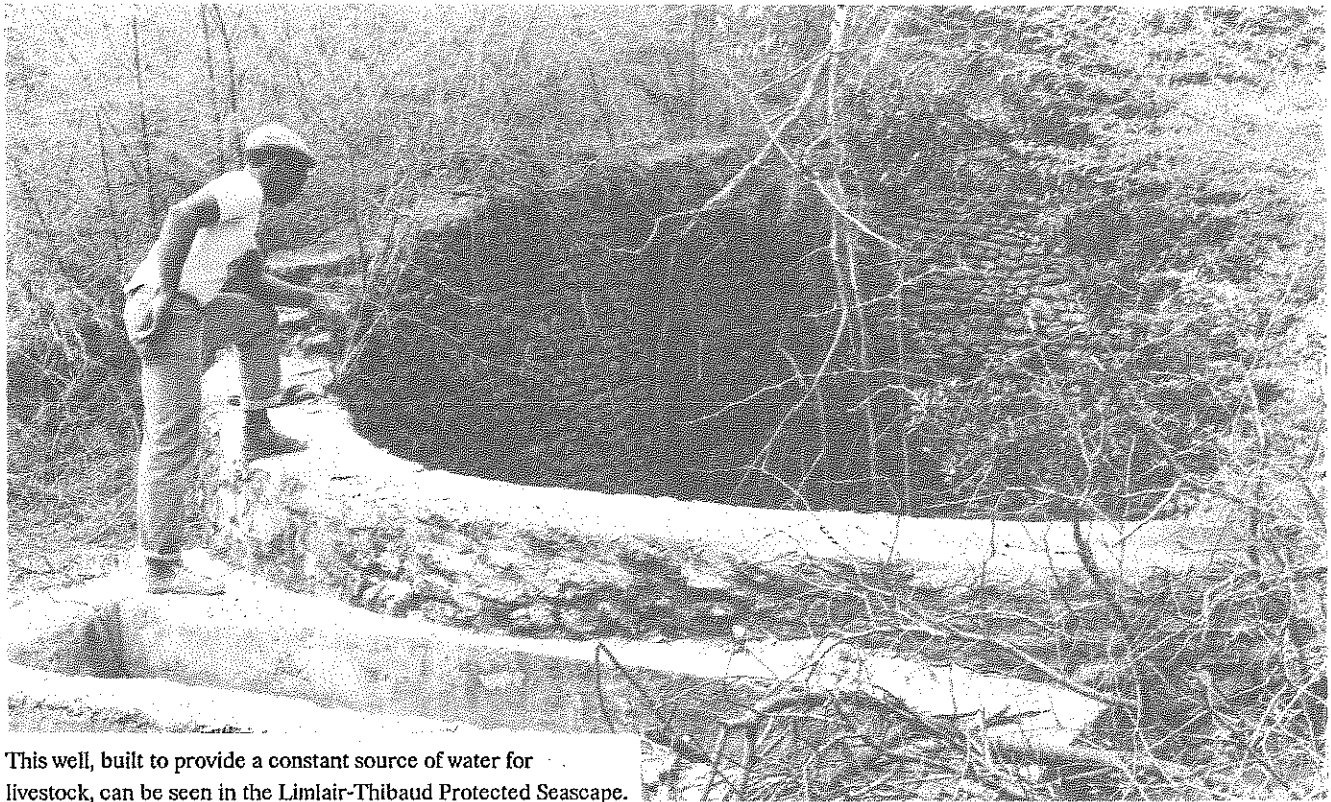
temperature averages about 80 degrees F. in the dry season and 74 degrees F. in the rainy season. Significantly less rain falls on the smaller Islands; from 50 - 70 inches per year. These drier conditions predominate because of their inability to cause condensation due to a lack of a high cordillera. On Union Island for example, a high rainfall count of 62.24 inches was tabulated, and a low of 25.7 inches with a 13 year average of 37.67 inches.

Land-use History

The Islands had a deep fertile soil at the time they were settled, which was utilized first primarily for cotton, a short time for sugar cane and thereafter for cotton. Sugar cane was phased out with the abolition of slavery and with the decline of the world price of sugar.



Old windmills such as this one found near the Belair Cultural Landmark serve as monuments to the agricultural productivity of Carriacou in the 1800's and early 1900's.



This well, built to provide a constant source of water for livestock, can be seen in the Limlair-Thibaud Protected Seascape.

Cotton is no longer an agricultural product, production having tapered over the last 40 years. As with any monoculture agriculture, insect infestation developed. The necessity of controlling the insect pests without insecticides led the farmers to rip out the annual crop and burn it thereby killing the insects and eliminating their food source. Even wild cotton was removed. The result was devastating as further soil erosion occurred at an accelerated rate.

Limes were also grown on Carriacou up until the turn of the century, but production per acre was less than the yields realized in Grenada. Lime production was profitable until 1920 when many of the groves were abandoned.

Coconuts were planted in the 1870's but were depleted in the late 1870's. Livestock were subsequently introduced on the smaller islands once soil fertility was depleted. Finally goats and black-bellied sheep were introduced and still provide improved breeding stock for Grenada. Sheep, cattle and goats are causing significant soil erosion resulting in decertification on the island. Compounding this problem is the "Let go

season" where the animals are released to fend for themselves during the dry season. They promote rill and gully erosion which down cuts the subsoil and as a result water storage capability is reduced. Animals also reduce reforestation efforts and potential crop production. Although animals are very important to the economy, fencing and pasture establishment is needed. Some coconut plantations still exist which are in need of management and protection.

Natural Vegetation

Beard's 1949 work, The Natural Vegetation of the Windward and Leeward Islands discusses "seasonal formations". When the evaporation from freshwater ponds and streams and the transpiration from plants exceeds the rainfall, a drought begins to occur. This is estimated to be at around 4 inches of rainfall per month (Charter, 1941). If the period of drought is short, the vegetation will be little affected, but longer droughts, as are characteristic during the dry season December through June, will adversely affect the diversity of flora. As a result, the smaller Islands are represented by a Dry Thorn Scrub - Cactus - Legume

Association at its best developed stage. The plants have leaves during the rainy season, and with the exception of a few species, are leafless during the dry season, hence the plant association Dry Deciduous Seasonal Forest.

Areas deforested and left to "old field succession" generally come back in pure stands depending on adjacent seed source, relief, and soils. Vegetative tufts of *Croton*, *Cordia*, or *Leucaena* can be found, as can *Bauhinia ungula* and *Cuidosolus ureus* (Howard, 1950) (Beard, 1949). These forest type sub-climaxes are found primarily on the leeward side of the Islands.

On the windward side of the Islands, *Coccoloba uvifera*, *Hippomane manchinella* and *Cocos nucifera* are found on the beaches on the moist lowlands which descend to sea level. On the slopes which begin from the wave cut cliffs, the contorted, wind sheared and salt sprayed growth of *Randia aculeata*, *Tabebuia pallida*, *Coccoloba caribaea*, and various species of *Capparis* predominate. *Opuntia dilleiri* and *Agave caribaeicola* are found on the most extreme rocky steep cliffs. More inland the typical spiny *Acacia* - *Albizzia* - *Pithecellobium* Association may be identified.

Dominants in the open woodland are *Bursera simaruba*, *Brosimum alicastrum*, *Pisonia fragrans*, *Ficus lentiginosa*, in order of frequency.

Three epiphytic air plants are noted. These are *Aechmea lingulata*, *Tillandsia utriculata* and *Tillandsia flexuosa*. The latter two are in the pineapple family.

Two rare and unusual plants found on Carriacou are *Morisonia americana* or jumbie sapodilla and *Lemna perpusilla* which has been found growing on the surface of ponds.

Brief History of Carriacou*

* The following section is adapted from Howard, (1950)

Carriacou is the largest of the Grenadines in Grenada territory. It is seven miles long and three miles wide at the broadest point. The island is irregular in shape with a ridge running the length of it averaging 750 feet in height with the highest point, a hill at the northern end called High North, reaching 850 feet above sea level.

Carriacou with a population of 5,000 or more is the seat of Government for the Grenada Grenadines. The largest town on the island is Hillsborough.

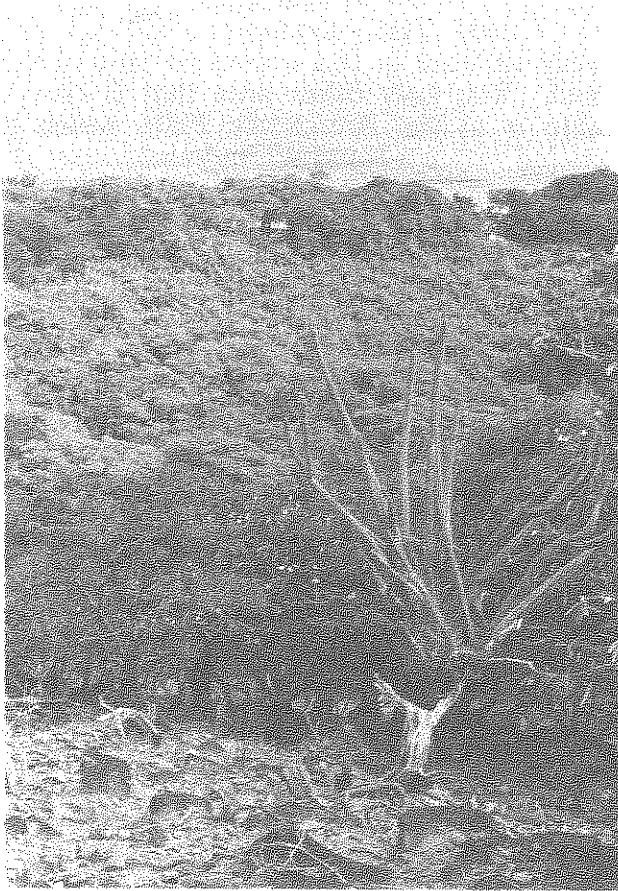
Carriacou is composed mainly of subsistence agriculturalists who cultivate vegetables including sweet potatoes, pigeon peas, and corn. Tomatoes and lettuce are grown in very small quantities. Small amounts of peanuts are grown for export.

In the past century Carriacou produced limes as the principal crop. Today, sugar is no longer grown and the lime industry is intermittent. Throughout the island one finds ruins of old houses and windmill towers which were used in grinding cane. Some of these features will be protected as cultural landmarks.

Water is a chronic problem on Carriacou. According to the historic documents the land was once forested and sugar was grown at the lower levels. Irrigation channels were established in the late 1700's and used to direct rainwater from the hills for agriculture. In 1891, according to Dr. Nichols' diary, water was in such short supply that it was necessary to import water for human consumption from Grenada. In 1891 a few wells were sunk to obtain ground water. One on the grounds of the old Limlair Estate is a recommended cultural landmark. Today, most houses have their own water collection and storage system. Lack of water remains one of the chief problems limiting development on the island.

The middle of the island is a designated forest reserve under the supervision of the Forestry Department. A representative of

the Forestry Department patrols the area to prevent the inhabitants of Carriacou from cutting wood and quarrying in the area.



The volcanic Mabouya Island off Carriacou has a dry thorn scrub vegetation with cactus and fragipani. It is part of a Protected Seascape.

The agriculture of a century ago covered practically all of the lands on Carriacou. Nichols reports cotton fields extending from the town of Hillsborough to the top of the ridge and continuous to the eastern coast and extending from one end of the island to the other. As a result, the intensive agricultural practices of over 200 years have left the island mostly deforested with eroded and infertile soils. Nevertheless, there are some commercial operations on Carriacou both in vegetables and fruits. The Forestry Department has initiated a Watershed Management Program.

The coast of Carriacou is largely coral or shoal formations and is wave-cut in the majority of places. Manchineel Bay and Carenage Bay near Harvey Vale have limited areas of beach, spectacular because they are of black sand formed from volcanic rock.

By contrast the beaches at Grand Anse on Hillsborough Bay are of white coral sands. While the limited black sand beaches support an *Avicennia* plant growth, those white beaches on the western side of the island are dominated by *Hippomane*, *Coccoloba uvifera* and *Erithallis fruticosa*. Some specimens of *Caesalpinia bonduc* scramble over the shrubs. *Crotalaria verrucosa* is a conspicuous blue-flowered herb in this beach association.

CHAPTER IV

ANALYSIS OF THE NATIONAL PARK SYSTEM

In order to determine the degree of representation of the Country's natural features, potential areas were identified and analyzed in the following ways:

- Representation of the geological formation composition and history and their significance to geomorphic and physiographic features in the area.

- Protection of native species of flora and fauna particularly those threatened with extinction.

- Representation and protection of ecosystems, through protection of watersheds and water courses. Maintain high standards of water quality and quantity, protection of sites and objects of cultural, historical and archeological heritage.

GEOLOGIC REPRESENTATION IN THE PROTECTED AREAS

The antilles volcanic arc dates back to the Eocene (50M. years ago). The products of the earliest phase are mainly underwater and are technically deformed. The phase of deformation ends with the Miocene (25M. years ago).

The vulcanism of the recent and active arc occurs after the new structural rearrangement of the area in the post Miocene times.

Grenada consists mainly of volcanic products and to a lesser degree, of sedimentary rocks. From the Miocene to Quaternary, volcanic activity has emitted a large quantity of products which vary both in chemical composition and in the way they were emitted. These result in domes, flows and a wide variety of pyroclastics related to eruptions with varying degrees of explosivity.

The Volcanic series visible on the island are

underlain by a sedimentary formation, where that sedimentary "Basement" outcrops on the island is known as the Tufton Hall Formation. This is made up of sandstones, siltstones and calcareous shale in alteration. The Tufton Hall formation outcrop are mainly situated in the northwest part of the island. The only other area that is clearly visible is at the Annandale Falls, which is included within a Natural Landmark.

The Central Southern Part of the Island (Grand Etang Forest-Reserve, and National Park, South of the highway)

The main area within this zone is the Mount Sinai, Mount Lebanon axis. It has been found that volcanic activity was most intense during these periods.

- (1) Middle Miocene (25M years ago) - characterized by Basic Magmas, Alkali Basalts and basic andesites. Few outcrops remain.

- (2) Pliocene age - Characterized by lava flows, prismatic factoring and altered pyroclastic deposits (Morne Rouge Bay)

- (3) Pleistocene age (1.7-1.4M years ago) - Activities of this period concerned the areas affected during the Middle Miocene period discussed above. This period's volcanic activity was characterized by mainly basic lava activity interspersed with major explosive activity shown by important pyroclastic deposits which are reworked.

The Volcanic Area of Mt. Granby - Grand Etang (Grand Etang National Park and northern part of Grand Etang highway)

This area was affected by volcanic activity in the Pliocene and the Pleistocene. This well preserved morphology suggests that volcanic activity continued until the very recent Holocene period in the Grand Etang area. In this area is the eroded remains of Miocene vulcanite outcrops below Plio - Pleistocene products.

It is believed that Mount Granby, Mount Qua Qua and other intermediate peaks were

separate centers of eruption which emitted lava at different times (Arcules 1973) and that volcanic activity began in the northern part near Mount Granby with the emission of basaltic lava which thereafter moved southward. Southward displacement would have brought the active centers close to Mount Qua Qua where both basaltic and andesite lavas are found.

The final element in this north - south migration of volcanic activity seems to be the craters located in the Grand Etang area. These are three craters one of them partially eroded all close together and a fourth at St. Margaret.

The Volcanic area of Mount St. Catherine (Mount St. Catherine National Park).

This volcanic edifice has a Pleistocene age and is characterized by a large crater, open on the southside with a diameter of about 1.2 KMS. Various domes have grown in the summit area there composition ranges from acid andesites to dacite and they constitute the main outcrops in the area.

According to Arculus (1973) the earliest activity was associated with the region in the vicinity of Plaisance and Malagon. Acidic lava flows ranging from andesite to dacites in composition were deposited on top of these early flows. Subsequently the center of activity moved southward probably near to the present crater of Mt. St. Catherine. The area to the northwest of this center is dominated by a thick sequence of andesitic and dacite lavas and pyroclastic flows forming St. Mark's mountain.

The climax of activity was probably the partial unfilling of the crater by the dome andesite.

Coastal Pleistocene Volcanic Cones (Levera and Archipelago, National Park, Lake Antoine, & Quarantine Point National Landmarks)

These recent emissions occur primarily in the Southwest and Northeast of the island

and include the St. George's Harbour, Queens Park, the crater at Woodford estate and at Quarantine Point.

Lake Antoine has morphological characteristics very similar to the typical tuff-rings produced by hydromagmatic eruptions. The lava block from Lake Antoine gave an age of approximately 1.5 M years.

The two craters near the Levera Hill seem to have had very minor interaction between the magma and the sea.

This volcanic area is characterized by a large andesitic dome, which is Levera Hill 848ft. above sea level and other smaller domes to the north west of the area. This is thought to have been formed about 7.1 M years ago during the upper Miocene period. The volcanic rocks of the Levera Hill area lie directly on the deformed Tufton Hall formation which outcrops at various points on the nearby coast.

VEGETATION REPRESENTATION

One of the primordial concerns of a National Parks and Protected Areas program is the protection of species and assemblages of species referred to as ecosystems. Plant species have contributed significantly to medicines and remedies and it is important to protect representative areas of the different ecosystems in Grenada as they may harbour valuable economic species.

Vegetative types can be analyzed with reference to both climate and edaphic (soils) conditions. Rainfall, altitude above sea level, and the actual height of mountain peaks will generally define vegetative associations. Soils will also cause differences in vegetative associations as will human influences relevant to past and present land-use.

As noted, most of the forests of Grenada and Carriacou were converted into agriculture over the last two centuries. The best representative examples of forest

ecosystems which remain in an unaltered state or in a good state of recovery have been recommended for inclusion within the system. The groups, series, formations, and associations based on (Beard, 1949) are presented in Table III. Table IV indicates which areas harbour the best ecosystem of its type in the country. The High North, Grand Etang, and Levera National Parks favour positively and as a result are the first priorities for development.

Three ecological associations are poorly represented.

(1) The Rain Forest and Lower Montane Rainforest which are referred to as the *Dacryodes Licania* association. The first example of this is in the Grand Etang Forest Reserve in the vicinity of the 7 Sister falls. The inaccessibility of this area made it uneconomical to harvest the timber or convert to agriculture.

(2) The Deciduous Seasonal Formation was also largely converted to agricultural production over time. Today only small remnant forests remain, but some areas show signs of recurrence on abandoned agricultural estates.

(3) The Dry Coastal Belt is only fairly represented but is also recuperating on some of the peninsulas on the southern coast and on Levera Hill where the forests have been staging a comeback due to abandoned agricultural practices. As these forests become more mature approaching a climax state they should be revived for inclusion within the system.

The swamps, namely the mangrove and freshwater herbaceous ecosystems, are in a healthy state. Mangrove cutting for charcoal has caused a deterioration of the resource in Levera and North East Seascape but management actions to prohibit this activity have been initiated.

WILDLIFE REPRESENTATION

Wildlife is noted to play an increasing role in the economic and social development of the country. Two hunters groups consider hunting an important recreational activity as well as source of protein. Some local creole dishes utilize wild meats which appeal to tourists and local people alike. The agouti *Dasyprocta liporina* is to be introduced into the wild. Liaison is occurring between Grenada and Trinidad and Tobago to provide a zoo and attempts will also be made to provide stock for the restoration of populations which have been depleted because of overhunting or habitat loss. An analysis has been made of the threatened and unique animal species (amphibian, reptile, bird, mammals, and fishes). The following Tables V through VIII indicate the species, status, habitat and principal units of the system where these species may be found.

Within this plan the following definition will apply to threatened species in Grenada and Carriacou:-

Endangered: taxa in danger of extinction and whose survival is unlikely if the casual factors continue operating.

Vulnerable: taxa believed likely to move into the endangered category in the near future if the causal factors continue operating.

Rare: taxa with small country populations that are not at present endangered or vulnerable, but are at risk.

Status uncertain: taxa that are suspected of belonging to one of the first three categories but for which insufficient information is currently available.

It should be noted in this section that although there has not been sufficient scientific study to determine exact ecological inter-dependencies and habitat requirements, an attempt has been made to assess habitat quality and animal species requirements. Having done this we can discern if specified wildlife species are able to find

adequate habitat.

The protected areas program attempts to maintain examples of the representative habitats in a healthy state. This provides the aspiration that species can continue evolving in their environment and have a good chance of survival.

CULTURAL REPRESENTATION

The National Parks and Protected Areas system in relation to cultural landmarks should be concerned primarily with in situ conservation and interpretation of monuments, sites, and structures which are representative of the various aspects of human life during the course of country's history. Expressions of Grenada's culture including artifacts, arts, traditions and preservation of historic buildings will not be the object of systematic attention, but will naturally be introduced in relation to the specific sites and resources incorporated within the system as recommended by the Grenada National Trust.

It is also understood that, for practical reasons, the urban environments should not be included within the framework at this stage. The links between urban heritage preservation and the establishment of a national park system however are significant and should be strengthened whenever feasible.

Two broad themes will guide the definition of the framework:

"Time": The evolution of the country and the history of its people.

"Space": The relationship between people and their environment. This relates to the use and transformation of the environment to satisfy human needs and to support economic activities.

The first theme can be divided into

four main periods, namely:

- The pre-colombian era.
- The pre-emancipation era (plantation system, sugar cane, slavery).
- The first emancipation era (diversification of pre-cultural production, establishment of peasantry, emancipation.)
- The contemporary period.

The second theme introduces:

- Human settlements (including architecture)
 - Production systems (including land use, agricultural production, and processing techniques.) These include:
 - * cane and sugar
 - * other export crops (coffee, nutmeg, cocoa, etc.) and
 - * fishing, boat building, and handicraft.
-

INVENTORY AND ANALYSIS OF
CULTURAL LANDMARKS

Period	Culture	Landmark	Date	Reason for Protection	Other Factors
Pre-Columbian	Arawaks Caribs	Mt. Rich Amerindian Ruins*	Pre-1498	Unique Petroglyphs	Beautiful River Setting
Colonial Period	French- British Military wars	Carib's Leap* Fort George* Fort Frederick* Fort Matthew Fort Adolphus Old Fort (Fort William Henry)	1651 1706 1779	Outstanding Engineering accomplishment Treaty of Paris (1763) Versailles (1783)	1983 PRG Disturbance
Introduction of coffee, cocoa		Estates in general	1714		
Rum Distillery and sugar manufacturing	French British African East Indian	River Antoine Rum Distillery* Westerhall Rum Distillery* Belair (Carriacou)*	1785 1800's	Oldest intact Rum Distillery and cane process- ing system in the Caribbean.	Fabulous setting
Slavery	African East Indian	Hermitage Slave Pen	Early 1800's		
Emmancipation	African East Indian	Fedon's Camp*	1795 1832 1838 1877	Civil & Political rights for free coloureds Slaves freed Grenada becomes a Crown Colony	
Post Sugar cane Plantation System (spices, coffee, nutmeg, cocoa, banana)	British French African East Indian	Montreuil Estate	1857	Productive Estate Cocoa replaces sugar as main crop	Beautiful setting

INVENTORY AND ANALYSIS OF CULTURAL LANDMARKS (cont'd)

Period	Culture	Landmark	Date	Reason for	Other		
Estates - Sugar cane, cocoa, nutmeg, production & Caribbean Style Architecture	British French African East Indian	The Tower*	1916				
		Samaritan Estate House					
		Morne Fendue House					
		Woodford Estate House					
		Beausejour Estate House					
		Douglaston Estate					
		Mount Rich Estate					
		Hermitage Estate House					
		Bocage Estate House					
		Grand Bacolet Estate House					
		Mt. Horne (Paraclette) Estate House					
		Bolonge					
		Contemporary Indigenous Technology representing historical methods	Grenadian	Marquis Village*	19th century + 20th century	Handicraft from wild pine	
				Soubise*	19th century + 20th century	Hand fashioned boats	
Grenada Handicraft Center - Tanteen	19th & 20th century			Pottery			
		Grencraft - St. George's		Basket weaving Handicraft furniture			

* Recommended for protection within this plan.

TABLE II
GEOLOGIC FEATURES BY PERIOD AND
THEIR REPRESENTATION IN THE
NATIONAL PARKS SYSTEM

GEOLOGIC PERIOD	FEATURE	SIGNIFICANCE	LOCATION	REPRESENTATION WITHIN PARK SYSTEM
Eocene to Lower Miocene	folded and faulted sedimentary formation with some volcanic minerals and tufaceous horizons (Tufton Hall Formation)	Oldest known rocks in Grenada. Deposited before vulcanism and then later deformed	Levera Bay, just north of beach. Also, southern Annandale Fall	Levera and Archipelago N.P. Annandale Falls N.L.
	Andesite domes Mt. Rodney, & Mt. Alexander	Oldest known Volcanic deposits in Grenada	Grenada, West of Sauteurs	
Upper Miocene	Andesite domes of Levera Hill and Levera (Sugar Loaf) Island	Good example of dome features, also shows intrusion through Tufton Hall Formation	Levera Bay	Levera and Archipelago N.P.
	Basalt flows of Southeast Mountain	Eruptive center for much of SE Grenada; also displays intense weathering of volcanic products	Northern and Northeastern ridges of Southeast Mountain	Grand Etang F.R.
	Andesite dome of Mt. Lebanon	Eruptive center; displays a contrast in rock composition from nearby Southeast Mountain	Mt. Lebanon	Grand Etang F.R.
	Andesite dome of Fedon's Camp	Locus of several eruptive centers which display variable rock compositions	Fedon's Camp	Grand Etang N.P.

Pliocene	Scoria and ash deposits	Example of Pyroclastic fall rock type	Quarantine Point	Quarantine Point N.L.
	Mt. St. Catherine andesite lavas, mudflows, pyroclastic flows and hot springs. Also, crater morphology and crater infilling by dome andesite	Youngest major eruptive center and highest point on Island. Displays a variety of rock types and geological processes	Mt. St. Catherine	Mt. St. Catherine N.P.
Pleistocene	Mt. Alexander Limestones exposed 100 m above sea level	One of only a few limestone formations in Grenada; also evidence for geological uplift since pleistocene	Mt. Alexander	
	Scoria and ash deposits, with some volcanic bombs, High Cliff Point	Excellent example of ash and scoria deposition. Also, volcanic bombs are present	High Cliff Point	Northern Seascape P.S
	Lake Antoine explosion craters (tuff ring)	Well-preserved example of an explosion crater and associated deposits	Lake Antoine	Lake Antoine
Pleistocene	Grand Etang explosion crater	Well-preserved examples of explosion Craters in the Island's interior	Grand Etang	Grand Etang N.P.
	Hot Springs and Boiling Springs	Indicates heat flow from depth	River Salle and Mt. St. Catherine area	River Salle N.L. Mt. St. Catherine N.P.

Holocene (Recent)	Rea Coastline and associated wetlands	Indicates subsidence of the Southeast coastline	Southeast coastline	Southern Seascape P.S. La Sagesse P.S.
Various ages	Reworked (fluvially deposited) volcanic rocks	Evidence of ancient erosion and deposition of volcanic products	Marquis Island and mainland shore	Marquis Island N.L.

Note: The number of features presented for each geological period is not any indication of the amount of volcanic activity for that period. Features were chosen on the basis of significance, state of preservation, and their occurrence within the National Parks System.

TABLE III
 EVALUATION OF THE VEGETATION OF
 GRENADA AND CARRIACOU BY REPRESENTATION
 IN THE NATIONAL PARK SYSTEM

A. GRENADA (Beard, 1949)

VEGETATION TYPES	ASSESSMENT	UNITS OF THE SYSTEM PROVIDING PRINCIPAL REPRESENTATION	QUANTITY	QUALITY
Climatic				
1. Rain Forest and Lower Montane Rain Forest <i>Dacryodes-Licania</i> association	Most of this faciation has been exploited, only small sectors remain in a Virgin state and are presently in the Grand Etang Forest Reserve & between Mt. Qua & Fedon's Camp	Grand Etang	Not Adequate	Fair
2. Montane Thicket <i>Micropholis chrysophylloides</i> <i>Licania ternatensis</i> <i>Euterpe globosa</i> <i>Dacrydes excelsa</i> <i>Richeria grandis</i>	Well represented around all peaks over 2000 feet.	Grand Etang Mt.St.Catherine	Adequate	Excellent

<p>3. Elfin woodland <i>Cyathea</i>, <i>Heliconia</i> <i>bihai</i>, <i>Euterpe</i> <i>globosa</i> <i>Charianthus</i> <i>purpureus</i> <i>Weigeltia</i> <i>antillana</i></p>	<p>Confined to summits of peaks of Grand Etang and Mt. St. Catherine</p>	<p>Grand Etang Mt.St.Catherine</p>	<p>Adequate</p>	<p>Excellent</p>
<p>4. Deciduous Seasonal Formation (Middle Belt). White Cedar Mahogany <i>Swietenia mahogoni</i> <i>Tabebuia pallida</i> <i>Guettarda scabra</i></p>	<p>Minute areas still remain, this area is poorly represented</p>	<p>Marquis River N.L.</p>	<p>Not Adequate</p>	<p>Fair</p>
<p>Dry Coastal Belt. Naked Indian - Hog Plum. Faciation <i>Bursera simaruba</i> <i>Albizia caribaea</i> <i>Spondias mombin</i></p>	<p>Very small areas remain, representation of this faciacion is fair</p>	<p>Canoe Bay La Sagesse Lake Antoine</p>	<p>Not Adequate</p>	<p>Good</p>

5. Dry Evergreen Formation Littoral Woodland Seaside grape Machineel association <i>Conocarpus erectus</i> <i>Tabebuia pallida</i> <i>Coccolobia uvifera</i> <i>Hippomane mancinella</i>	Relatively well represented, but most coastal areas are being exploited for charcoal or decimated by goat grazing	Northern Seascape La Sagesse Canoe Bay Levera Hog Island Calivigny Southern Seascape	Adequate	Excellent
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Edaphic

6. Herbaceous Swamp Papyrus Bog Association	Two small Caldera Lakes	Lake Antoine Grand Etang Lake	Adequate	Good
Mangrove Woodland <i>Rhizophora</i> <i>Avicennia</i> <i>Laguncularia</i> <i>Conocarpus</i>	Exploited all over for charcoal	Levera Northern Seascape Southern Seascape Hog Island	Adequate	Good

B. CARRIACOU (Howard, 1950)

Climatic

1. Deciduous Seasonal Formation (Dry Woodland) <i>Bursera simaruba</i> <i>Brosium alicastrum</i> <i>Pisonia fragrans</i> <i>Ficus lentiginosa</i> <i>Lonchocarpus sp.</i>	Found only in the North and the Forest Reserves. This association badly affected by overgrazing	High North Forest Reserve	Adequate	Good
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*Swietenia
mohogani*

Dry Thorn-
Cactus
Scrub
*Opuntia
dillenii*
Randia sp.
Piscidia sp.

Badly over
exploited by
goat grazing

High North
Limlair-
Thiboud
Saline/White
Islands
Sabazan

Adequate

Good

Edaphic

2. Mangrove
Woodland

Well represent-
ed primarily
because the
mangroves are
not cropped for
charcoal

High North
Lauriston-
Mabouya
Tyrrel Bay

Adequate

Excellent

TABLE IV
 PRIORITY AREAS FOR PROTECTION OF REPRESENTATIVE
 SAMPLES OF GRENADA ECOSYSTEMS

- * Large Area
 o Medium to small area
 x Best in Country

Parks are listed in
 order from most
 diverse to least
 diverse (excluding
 Cultural Landmarks
 & Multiple Use)

	LITTORAL WOODLAND	CACTUS SCRUB	DRY WOODLAND	MOIST FOREST	RAIN FOREST	CLOUD FOREST	"ELFIN WOODLAND"	RIVERINE ECOSYSTEM	FRESHWATER HERBACIOUS SWAMP	MANGROVE - MUDFLAITS ESTUARY	SALT POND	SEAGRASS BED	CORAL REEF	SMALL ISLAND ECOSYSTEM	OBSERVATIONS
HIGH NORTH	*	*	x				o			x	o	*	*	*	Highest Peak in Carriacou
GRAND ETANG				x	x	x	x	x	*						High Tourism/ Scenic Value
LEVERA	*	x	*	*				*		*	*	*	*	x	High Tourism/ Scenic Value
SALINE ISLAND/ WHITE ISLAND	*	*	*							*	x	*	x	*	Excellent nesting habitat-birds and Iguanas
MT. ST. CATHERINE					*	*	*								Highest peak in Grenada
NORTHERN SEASCAPE	x	*	*					*		*	*	*	*	*	Finfish Production
LAURISTON-MABOUYA SANDY ISLE	*	*	o							*		o	*	*	High Tourism/ Scenic Value
TYRREL BAY	o	o						o		*	*	o	o	o	Breeding & nesting habitat. Finfish production
HOG ISLAND	*	*	*							o	o	*	*	*	High Tourism/ Scenic Value
LA SAGESSE	*	*	*					*		*	*	*	x	*	Best Salt Pond in Grenada

- * Large Area
- o Medium to small area
- x Best in Country

Parks are listed in order from most diverse to least diverse (excluding Cultural Landmarks & Multiple Use)

LITTORAL WOODLAND
 CACTUS SCRUB
 DRY WOODLAND
 MOIST FOREST
 RAIN FOREST
 CLOUD FOREST
 "ELFIN WOODLAND"
 RIVERINE ECOSYSTEM
 FRESHWATER HERBACIOUS SWAMP
 MANGROVE - MUDFLATS
 ESTUARY
 SALT POND
 SEAGRASS BED
 CORAL REEF
 SMALL ISLAND ECOSYSTEM

OBSERVATIONS

	LITTORAL WOODLAND	CACTUS SCRUB	DRY WOODLAND	MOIST FOREST	RAIN FOREST	CLOUD FOREST	"ELFIN WOODLAND"	RIVERINE ECOSYSTEM	FRESHWATER HERBACIOUS SWAMP	MANGROVE - MUDFLATS	ESTUARY	SALT POND	SEAGRASS BED	CORAL REEF	SMALL ISLAND ECOSYSTEM	OBSERVATIONS
SOUTHERN SEASCAPE	*							*		*	*		*	*		Important for finfish production Product Estuary
MOLINERE REEF	*	*											o	*		Finest Reefs in Grenada
LA BAYE ROCK			o										*	*	*	Breeding & Nesting habitat
LIMLAIR-THIBOUD	*	*						o		o			*	*		High Cultural value
CALIVIGNY ISLAND	*									o		o	*	*	*	High Tourism/ Scenic Value
LAKE ANTOINE			*						x							Unique Ecosystem
SABAZAN		o	o										o	o		High Cultural value
MARQUIS ISLAND		o	*										*	*	*	Area of Geologic Interest
ANNANDALE FALLS				o				*								High Recreation Potential
MARQUIS RIVER				o				*								High Recreation Potential
CONCORD FALLS				o				*								High Recreation Potential
QUARANTINE POINT		o	o													High Recreation Potential
RIVER SALLEE BOILING SPRINGS								*								Area of Geologic Interest

TABLE V
 THREATENED AMPHIBIAN SPECIES
 AND
 THEIR PROTECTION IN
 THE NATIONAL PARK SYSTEM

SPECIES	STATUS	SOME HABITAT REQUIREMENTS	PRINCIPAL UNITS OF THE SYSTEM PROVIDING HABITAT
Giant toad (<i>Bufo marinus</i>)	Rare	Somewhat common in forest areas	Grand Etang N.P. Mt. St. Catherine N.P. Forest Reserves Multiple use areas
Piping frog (<i>Eleutherodactylus johnstonei</i>)	Status Uncertain	Forested areas	Grand Etang N.P. Mt. St. Catherine N.P. Forest Reserves Multiple use areas
Highland piping frog (<i>Eleutherodactylus urichi</i>)	Status Uncertain	Confined to virgin forests of the Grand Etang area	Grand Etang N.P.
Giant woodland frog (<i>Leptodactylus fallax</i>)	Status Uncertain	Forested Areas	Grand Etang N.P.

TABLE VI
THREATENED REPTILE SPECIES
AND
THEIR PROTECTION IN
THE NATIONAL PARK SYSTEM

SPECIES	STATUS	SOME HABITAT REQUIREMENTS	PRINCIPAL UNITS OF THE SYSTEM PROVIDING HABITAT
<p>SNAKES</p> <p>(Grenada has no venomous snakes)</p>			
White headed worm snake <i>(Leptotyphlops margaritae)</i>	Status Uncertain	Forested Areas	Levera N.P. High North N.P.
The Tree boa or <i>(Corallus (enydris cookii)</i>	Status Uncertain	Forested, normally dry areas	Levera N.P. High North N.P.
Boddaert's Tree Snake <i>(Mastigodryas bruesi)</i>	Rare	Forested, normally dry areas grassland and open forest	Hog Island N.L. Levera N.P. High North N.P.
<i>(Clelia clelia)</i>	Status Uncertain	Wet forested areas	Grand Etang N.P. Mt. St. Catherine
Neuweid's moon snake <i>(Pseudoboa neuwiedi)</i>	Endangered Possibly Extinct	Forested areas	Grand Etang N.P. Mt. St. Catherine
Shaw's Racer <i>(Liophis melanotus)</i>	Endangered Possibly Extinct	Wet forested areas	Grand Etang N.P. Mt. St. Catherine
<i>(Typhlops tasymicris)</i>	Rare, Known only from the St. David's Parish	Moist Forested area	Levera N.P.

LIZARDS*

Crested anole or tree lizard (<i>Anolis richardi</i>)	Status Uncertain	Forested areas	High North N.P. Levera N.P.
(<i>Iguana iguana</i>)	Threatened Possible sub-species	Dry thorn scrub	Hog Island N.L. Levera N.P. Southern Seascape P.S White Island/ Saline Island P.S.
Garman ground lizard (<i>Ameiva tobagana</i>)	Status Uncertain	Forested areas	Northern Seascape Limlair - Thiboud Levera N.P.
Allen's Ground lizard (<i>Bachia heteropus alleni</i>)	Status Uncertain	Lowland dry scrub forest	Northern Seascape P.S Levera N.P. High North N.P.
South Antillean Slippery back lizard (<i>Mabuya mabouya</i>)	Status Uncertain	Lowland dry scrub forest	Northern Seascape P.S Levera N.P. High North N.P.

* Some lizards are in danger of extinction from the devastation of the mongoose. (Groom, 1970)

THREATENED REPTILE SPECIES
AND
THEIR PROTECTION IN
THE NATIONAL PARK SYSTEM

SPECIES	STATUS	SOME HABITAT REQUIREMENTS	PRINCIPAL UNITS OF THE SYSTEM PROVIDING HABITAT
SEA TURTLES* AND OTHERS			
Green turtle (<i>Chelonia mydas</i>)	Endangered	Nesting in small sheltered bays, feeds near eel grass beds	Northern Seascape P.S. Levera N.P. La Sagesse P.S. High North N.P. White/Saline Islands P.S.
Hawksbill turtle (<i>Eretmochelys imbricata</i>)	Endangered	Nesting in small sheltered bays	"
Leatherback (<i>Dermochelys coriacea</i>)	Endangered	Nesting on open beaches with strong surf	"
Loggerhead turtle (<i>Caretta caretta</i>)	Endangered	Nesting in small sheltered bays	"
Ridley or Kemp's (<i>Lepidochelys olivacea</i>)	Endangered	Nesting in small sheltered bays	"
Morocoy tortoise (<i>Geochelone carbonaria</i>)	Threatened possibly extinct in the wild in Grenada (Groom, 1970)	Forested Area Small Islands	Grand Etang N.P. High North N.P. Saline/White Islands P.S.

* Most Sea Turtles are endangered because they are hunted for their meat and shells, and because their habitat for nesting, the beaches, are becoming developed. The five potential beach sites which provide suitable habitat for the sea turtles are mentioned but there is need for added research.

TABLE VII
THREATENED BIRD SPECIES
AND THEIR PROTECTION IN
THE NATIONAL PARK SYSTEM

SPECIES	STATUS	HABITAT	PRINCIPAL UNITS OF THE SYSTEM PROVIDING HABITAT
Audubon's shearwater (<i>Puffinus iherminieri</i>)	Vulnerable	Remote area; with coastal cliffs	Saline Island/ White Island Northern Seascape High North
Bat falcon (<i>Falco rufigularis</i>)	Vulnerable	Montane rain forest	Grand Etang
Black skimmer (<i>Rynchops nigra</i>)	Vulnerable	Sea Coast	Saline Island/ White Island Northern Seascape
Black-crowned night- heron (<i>Nycticorax nycticorax</i>)	Vulnerable	Mangrove swamp	High North Mabouya-Sandy Isle Levera
Black tern (<i>Chilodnias niger</i>)	Vulnerable	Sea Coast	Northern Seascape
Blue-ground dove (<i>Claravis pretiosa</i>)	Vulnerable	Montane rain forest and tropical deciduous forest	Grand Etang
Blue-hooded euphonia (<i>Euphonia musica</i>)	Endangered	Montane rain forest	Grand Etang
Blue tailed emerald humming bird (<i>Chlorostilbon mellisugus</i>)	Endangered	Tropical forest	Levera
Bridled-tern (<i>Sterna anaethetus</i>)	Vulnerable	Remote areas with coastal	High North Marquis Island

Broad-winged hawk (<i>Buteo platypterus</i>)	Endangered	cliffs Tropical rain and lower montane forest	Mt. St. Catherine
Brown booby (<i>Sula leucogaster</i>)	Vulnerable	Remote areas with cliffs, crevices and sparse vegetation	La Baye Rock Saline Island/ White Island
Brown-crested flycatcher (<i>Myiarchus tyrannulus</i>)	Vulnerable	Semi-deciduous secondary forest	La Sagesse High North
Brown noddy (<i>Anous stolidus</i>)	Vulnerable	Remote areas with steep cliffs, crevices and sparse vegetation	La Baye Rock
Brown pelican (<i>Pelecanus occidentalis</i>)	Vulnerable	Isolated areas with steep cliffs, crevices and sparse vegetation	Saline Island/ White Island
Caribbean martin (<i>Progne domini- censis</i>)	Vulnerable	Remote areas with steep coastal cliffs	Northern Seascape
Common stilt (<i>Himantopus himantopus</i>)	Vulnerable	Mangrove swamp	Levera
Common snipe (Breeding) (<i>Gallinago gallinago</i>)	Endangered	Marsh and forest	Levera
Everglade kite (<i>Rostrhamus sociabilis</i>)	Endangered	Herbaceous swamp	Levera Lake Antoine

Fulvous tree-duck (<i>Dendrocygna bicolor</i>)	Endangered	Mangrove and herbaceous swamp	Levera Lake Antoine
Grenada flycatcher (<i>Myiarchus nugator</i>)	Endemic Vulnerable	Dry Thorn scrub	White/Saline Levera
Grenada dove (<i>Leptotilia wellsi</i>)	Endemic Endangered	Xerophytic scrublands	Canoe bay
Garnet throated hummingbird (<i>Evlampis jugularis</i>)	Vulnerable	Forest	Grand Etang
Gray kingbird (<i>Tyrannus dominicensis</i>)	Vulnerable	Herbaceous swamp	Grand Etang Lake Antoine
Great egret (Breeding) (<i>Casmerodius albus</i>)	Endangered	Mangrove swamp	Tyrrel Bay
Green heron (<i>Butorides virescens</i>)	Vulnerable	Sea-coast and mangrove swamp	High North
Large-billed seed-finch (<i>Dryzoborus crassirostris</i>)	Endangered	Herbaceous swamp	Lake Antoine
Laughing gull (<i>Larus atricilla</i>)	Vulnerable	Remote island with steep coastal areas and cliffs	La Baye Rock Saline Is./ White Island
Least tern (<i>Sterna albifrons</i>)	Vulnerable	Sea coast	Northern Seascape
Lesser Antillean Bullfinch (<i>Loxigilla noctis</i>)	Vulnerable	Sea Coast	High North
Lesser antillean tanager (<i>Tangara cucullata</i>)	Vulnerable	Sea Coastal Mangrove swamp	White/Saline High North Levera
Lesser elaenia (<i>Elaenia chiriguensis</i>)	Endangered	Marsh and forest	Southern Seascape

Lesser seed-finch (<i>Oryzoborus angolensis</i>)	Endangered	Herbaceous swamp and marsh forest palm marsh and deciduous forest	High North Levera
Lesser swallow-tailed swift (<i>Panyptila cayennensis</i>)	Vulnerable	Montane rain forest	Grand Etang
Limpkin (<i>Aramus guarauna</i>)	Endangered	Herbaceous swamp	Lake Antoine
Little blue heron (<i>Florida caerulea</i>)	Vulnerable	Sea coast and mangrove swamp	Southern Seascape
Magnificent frigate-bird (<i>Fregata magnificens</i>)	Vulnerable	Isolated areas with steep cliffs, crevices and sparse vegetation	La Baye Rock Marquis Island
Mangrove cuckoo (<i>Coccyzus minor</i>)	Vulnerable	Mangrove swamp	Levera High North
Masked duck (<i>Oxyura dominical</i>)	Endangered	Mangrove swamp	Levera La Sagesse
Plain-breasted ground-dove (<i>Columbina minuta</i>)	Vulnerable	Marsh and forest	Northern Seascape
Red-billed tropic bird (<i>Phaethon aethereus</i>)	Vulnerable	Isolated areas with coastal cliffs	La Baye Rock
Roseate tern (<i>Sterna dougallii</i>)	Vulnerable	Remote island with coastal cliffs	Saline/ White Island
Royal tern (<i>Sterna maxima</i>)	Vulnerable	Isolated area with steep cliffs, crevices and sparse vegetation	Hog Island Calivigny Island
Ruddy quail-dove (<i>Geotrygon montana</i>)	Vulnerable	Montaine rain forest	Mt. St. Catherine

Sandwich tern (<i>Sterna sand- vicensis</i>)	Vulnerable	Remote areas with steep cliffs, crevices and sparse vegetation	Southern Seascape
Scaley breasted thrasher (<i>Margarops fuscas</i>)	Endangered Possibly Extinct	Dry thorn scrub	White/Saline High North
Scarlet ibis (<i>Eudocimus ruber</i>)	Endangered Possibly Extinct	Mangrove swamp	Levera
Snowy egret (<i>Egretta thula</i>)	Vulnerable	Sea coast and mangrove swamp	Southern Seascape
Sooty tern (<i>Sterna fuscata</i>)	Vulnerable	Remote areas with steep cliffs, crevices and sparse vegetation	Northern Seascape
Spotted rail (<i>Rallus maculatus</i>)	Vulnerable	Mangrove swamp	Tyrrel Bay High North Levera
Swallow-tailed Kite (<i>Elanoides forficatus</i>)	Endangered	Montane rain forest	Mt. St. Catherine
White-cheeked pintail (<i>Anas bahamensis</i>)	Vulnerable	Mangrove forest and sea-coast	High North Levera
White-necked thrush (<i>Turdus albicollis</i>)	Vulnerable	Tropical forest	High North
Yellow-billed tern (<i>Sterna superciliaris</i>)	Vulnerable	Sea coast	Northern Seascape

TABLE VIII
THREATENED MAMMAL SPECIES
AND
THEIR PROTECTION IN
THE NATIONAL PARK SYSTEM

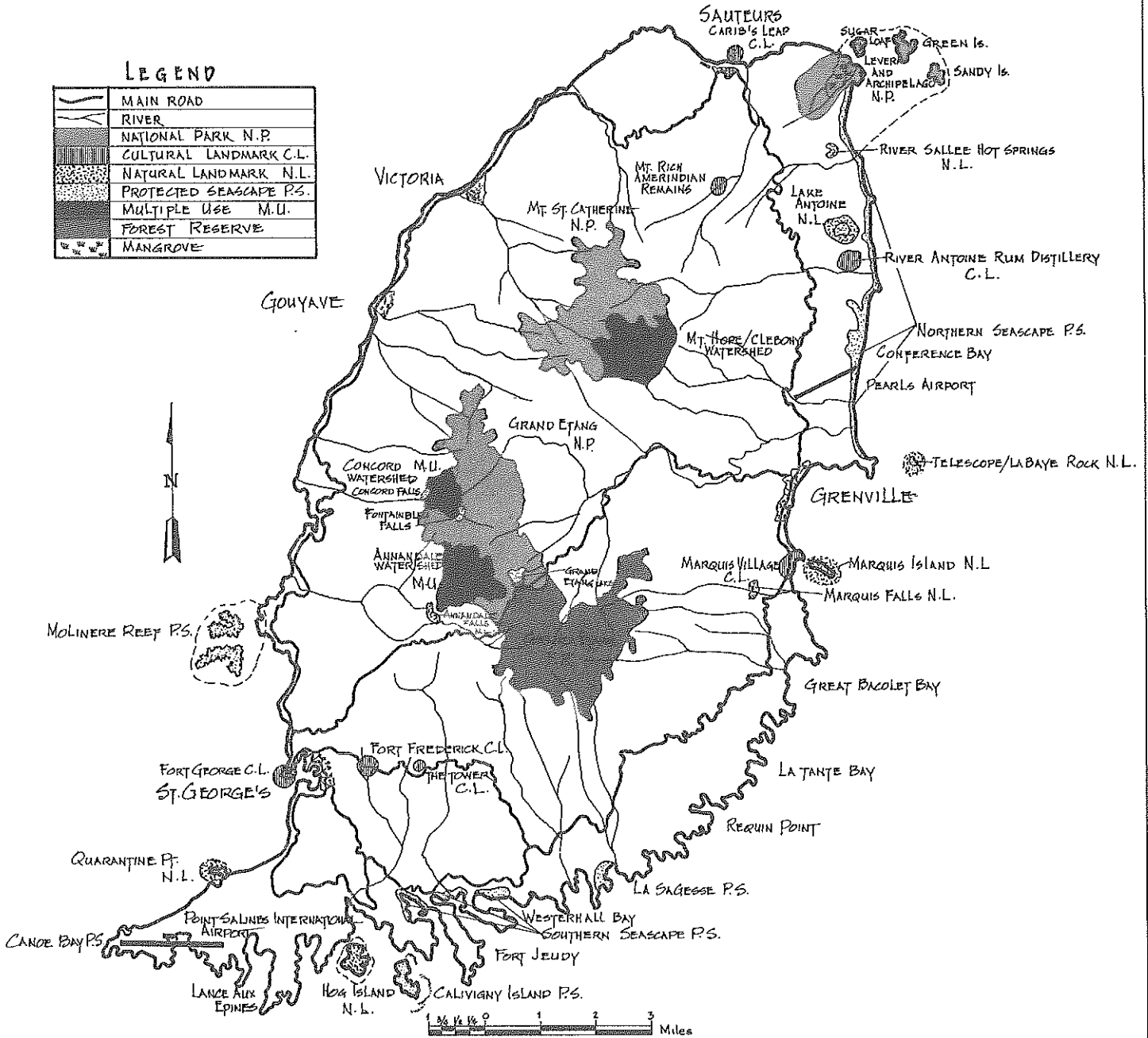
SPECIES	STATUS	HABITAT	PRINCIPAL UNITS OF THE SYSTEM PROVIDING HABITAT
Nine-banded armadillo (tatou) (<i>Dasyus novemcinctus novemcinctus</i>)	Rare	Forested as well as areas of mixed vegetation	Grand Etang N.P. Mt. St. Catherine N.P. Multiple use areas
Lesser Chapman's murine opossum (<i>Marmosa fuscata carri</i>)	Vulnerable	Forested, normally dry areas	Levera N.P.
Greater Chapman's murine opossum (<i>Marmosa robinsoni chapmani</i>)	Rare	Forested areas	Grand Etang N.P. Mt. St. Catherine N.P. Multiple use areas
Agouti (<i>Dasyprocta leporina</i>)	Endangered Possibly Extinct	Forested areas	Grand Etang N.P. Mt. St. Catherine N.P.
FISH FAUNA	DISTRIBUTION		PRINCIPAL UNITS OF THE SYSTEM PROVIDING HABITAT
Freshwater Fish			
Antillean fish fauna dominated by gobies, mountain mullets, cling fish and several sea run species	Endangered due to sedimentation and pollution in the river systems from inappropriate land- use practices on steep slopes		Grand Etang N.P. Estuaries of Northern P.S. Southern P.S.
Tete-chien (<i>Syn branchus marmoratus</i>)	Rare		Northern P.S. Southern P.S.
Go bird fish (<i>Cicydium phimieri</i>)	Rare		Northern P.S. Southern P.S.

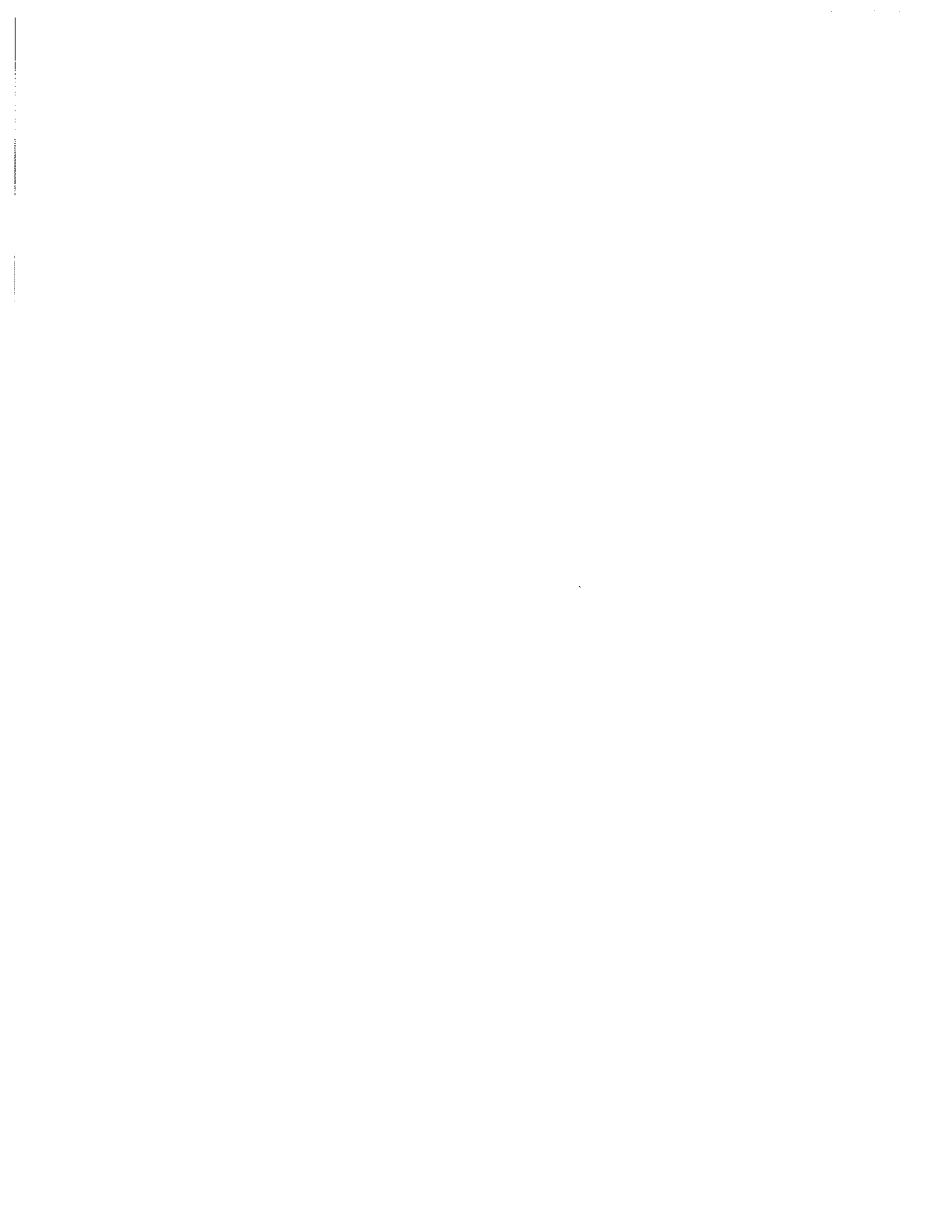
NATIONAL PARKS AND PROTECTED AREAS(Grenada)

GOVERNMENT OF GRENADA/OAS PROJECT
 THE ESTABLISHMENT AND MANAGEMENT OF
 A SYSTEM OF NATIONAL PARKS AND
 PROTECTED AREAS

LEGEND

	MAIN ROAD
	RIVER
	NATIONAL PARK N.P.
	CULTURAL LANDMARK C.L.
	NATURAL LANDMARK N.L.
	PROTECTED SEASCAPE P.S.
	MULTIPLE USE M.U.
	FOREST RESERVE
	MANGROVE





CHAPTER V

THE UNITS OF THE NATIONAL PARK SYSTEM

The National Park System's Plan envisages the creation of units in both Grenada and Carriacou. A National Parks program is necessary to carry out the Government of Grenada policy and objectives for the protection and use of the outstanding natural heritage resources of the Country.

The following section provides a summary of each area within the system, gives its significance, the principal management objectives and a synopsis of the initial management activities that will be required for the area.

GRENADA

NATIONAL PARKS

(i) GRAND ETANG

Location: In the South-centre of Grenada North-east of the town of St. George's.

Summary Description: Located within the Central Mountain Range in the Southern half of the Island. The unit extends from the North-west to the South-east, encompassing the several mountain peaks which rise to over 2000 feet. Included are the peaks of Mount Grandby, Fedon's Camp and Mount Qua Qua. Several of these contain old crater basins one of which is occupied by a large crater lake - Grand Etang, 1740 feet above sea level. The craters represent different centers of volcanic activities between the Miocene and Pleistocene geological periods.

The vegetation cover is characterized by Montane and Elfin forest on the steeper slopes throughout the higher region. There the trees are smaller at lower altitudes and are more thickly covered with epiphytes such as ferns and mosses. On exposed ridges and high peaks amidst the drifting clouds the densely growing trees are stunted and

twisted into strange shapes, hence the name "Elfin Woodland".

This rugged isolated area provides habitat for many species of birds, mammals and reptiles that are endangered through excessive hunting, trapping, or habitat loss.

The land capability survey indicates that most of that area has greater than the 30 percent slope or falls into the "E" slope category and is therefore unsuitable for agricultural use.

The area is also of historic importance because the summit, referred to as Fedon's Camp, was the center of the Fedon's rebellion against the British after the Island was restored to Great Britain by the Treaty of Versailles in 1783.



Visitors to the Grand Etang Lake follow the self-guiding environmental education trail which indicates points of interest.



Participants of the first Environment Education Workshop held in the Grand Etang Forest Centre drew up an interpretive plan for the area.

Significance of Area: The south central mountains represent one of the most outstanding natural forest areas on the Island. It provides excellent habitat for the endangered species on the Island including the nine banded armadillo, and wholly opossum. The agouti, thought to be extinct is to be re-introduced into the area in 1987. The Grand Etang mountain area is important because it is the major catchment area for the domestic water supply of the Southern part of the Island including St. George's. It is also an important scientific, educational and recreational area in close proximity to the capital and major tourist development.

Management Objectives: To protect the natural forest ecosystem in an undisturbed condition and provide habitat for fauna particularly those threatened with extinction. Also to provide opportunities for environmental education, research and low density recreation.

Activities: Demarcation of Park's boundaries, continuation of the upgrading of Grand Etang's Interpretation Center and nature trails. Develop a management programme for the national park.

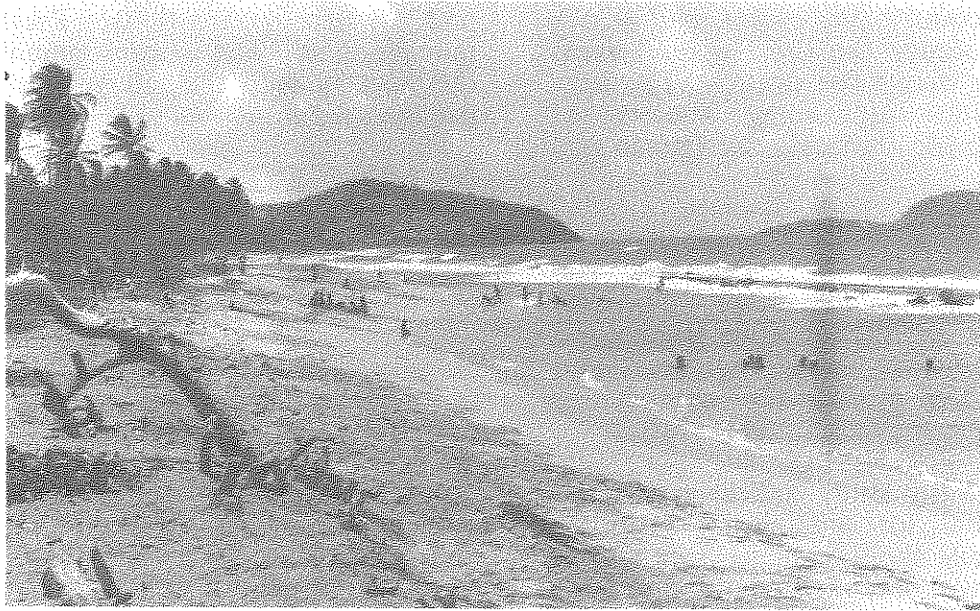
(ii) LEVERA AND ARCHIPELAGO:

Location: The North-eastern end of the Island including the Levera pond and three Islands to the North-east.

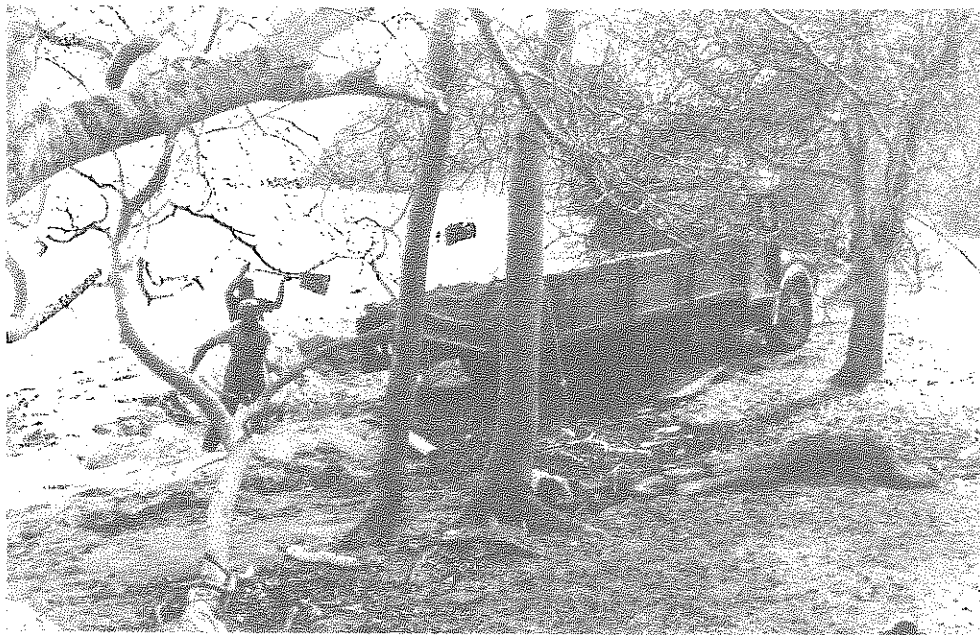
Summary Description: Included within the Levera Archipelago National Park are two conical shaped hills, one on the mainland known as Levera Hill, and the other forming an Island called "Sugar Loaf" or Levera Island. Between these two peaks is a depression occupied by twenty three (23) acres of water known as the Levera Pond. This is surrounded by red and white mangroves and has an outlet to the sea.

Also included within this unit are Green and Sandy Islands and the marine area between these and the mainland.

The flora includes one of the largest areas of mangrove swamp in the Country. This mangrove ecosystem is highly productive and probably the most important habitat for many important aquatic species as well as other species of birds including the scarlet ibis. This mangrove swamp is the northern most extension of the scarlet ibis.



Hundreds of visitors travel to Levera National Park every weekend for swimming and hiking.



Sand mining on unauthorized beaches causes accelerated erosion of the coastline and threatens the long term appropriate use of these resources.

This unit is the only representative area of the coastal type vegetation developed in areas of a marked dry season and constant saline air. Coconut palm, cactus, and woody scrub growth occupy the drier upland areas adjacent to the mangrove swamp. The area provides habitat for many species of indigenous wild life including the iguana and land crabs.

The coastal area is reputed to be the most scenic and spectacular in the Country. The many white sand beaches are important hatching ground for turtles while the marine areas are famous for their coral reefs and sea grass beds that provide food and shelter for lobsters and many beautiful reef fishes.

The land capability study indicates that the area is marginal for agricultural purposes since it has very shallow saline soil and is very dry for almost nine months of the year.

Significance of Area: The Levera pond and extensive mangrove swamp represents the most outstanding example of the mangrove swamp ecosystem on the Island of Grenada. It provides the only habitat where a large variety of birds and aquatic life can be observed. It is the only roosting area in Grenada for the scarlet ibis.

The area forms an interesting example of the land/water interface. It provides nutrients for finfish and shellfish important to the fishing industry and provides an area of floodwaters storage.

It is a relatively isolated area that will be in great demand for the development of tourism accommodations. Levera is therefore an important recreation and education area that is of aesthetic and scientific value.

Management Objectives: To protect the mangrove ecosystem and to provide opportunities for environmental education and interpretation. To protect this unique natural environment, off-shore islands and marine resources while allowing the development of appropriate recreational activities.

Activities: Acquisition of land and islands by the State for the benefit of the present and future generations. Preparation of management and development plan in conjunction with the villagers who presently use the area.

(iii) MOUNT ST. CATHERINE

Location: Northern center of the Island, east of the towns of Gouyave and Victoria and west of the old Pearls airstrip.

Summary Description: Mount Saint Catherine at 2,756 feet above sea level is the highest mountain peak in the Country. It is a large volcanic mountain formed during the pleistocene glacial epoch and has a large open crater on the south side. Many peaks and ridges surround it forming the north central mountain range, which are out cropped by acid andesites and dacites.

The vegetation within this area is virtually undisturbed by hurricanes. Elfin and Montane forest are dominated by *Micropholis chrysophylloides*, *Licania ternatensis*, *Euterpe globosa* and *Dacryodes excelsa*.

The area provides habitat for many species of indigenous wildlife. This is the only area within the country that is not dissected by roads.

Above the 1600 feet contour line which demarcates the park boundary, the land is mostly covered by natural or partially disturbed forest. The area is steep, rugged and very difficult to access for agricultural purposes although the area is used for hunting and recreation. Land capability studies recommend that with the exception of a few small patches of gentle slopes the area should remain under indigenous forest cover. Over 90% of the National Park falls into Land use category VIe, and is therefore unsuitable for cultivation.

Significance of Area: The Mount St. Catherine range represents the least disturbed ecosystem in the north of Grenada.

It is also the major water catchment area or source of domestic water for the towns and villages of the northern half of Grenada.

Management Objectives: To protect in an undisturbed condition the important natural associations and landforms within the area and to provide adventurous recreational pursuits.

Activities: Establishment of boundaries and the development of a Management Programme emphasizing enforcement of regulations geared towards the protection of the area.

NATURAL LANDMARKS

(1) LAKE ANTOINE

Location: Eastern side of Grenada approximately six miles north of the town Grenville.

Summary Description: Lake Antoine occupies about 16 acres within a perfect crater in the north east of the Island. It represents an excellent example of a crater lake formed by volcanic eruptions. The crater was once a volcano which collapsed into its present crater like form. The water level of the crater lake is normally not more than twenty feet above sea level. The feature is both geomorphologically and aesthetical interesting. While the lower slopes have been used for agricultural purposes, the crest is still covered with forest.

The area recommended for protection is privately owned and forms part of the River Antoine that is of historic importance for its functional sugar mill and rum refinery.

The lake is also an important nesting ground for many species of birds and other wildlife. Although remotely located, the feature is well visited by tourist and locals.

Significance of Area: The Lake Antoine crater is a geologically unique phenomenon and is reported to be one of the most scenic features throughout the Island.

Management Objectives: To maintain the crater lake as an aesthetically attractive environment and provide for interpretation of the geological, historical and natural features of the landmark.

Activities: Develop a land use and interpretation plan together with the owners emphasizing the provision of visitor facilities, maintenance of roads and infrastructure to the crater lake. An environmental education trail will be designed to indicate points of interest.

(ii) CONCORD FALLS

Location: Within the Concord Valley, along



the Concord River between Mount Qua Qua and the West Coast.

Summary Description: Along the Concord River two very picturesque natural waterfalls exist apparently formed by the erosion of a band of soft rock. Located downstream, a band of hard rock was formed by the extension of lava from the eruptions. This is part of the lava flow that created the south central mountain system. The Concord (or first falls) utilized by dozens of recreationalists on a given weekend is located at the eastern end of a properly surfaced access way. The waterfall plunges approximately thirty five feet creating a pool of fresh water ideally suited for swimming.

The adjacent lands are privately owned and the owner is in the process of establishing a snack and rest-house facility. About 10 minutes hike upstream along a well constructed trail is the Fountainbleau Falls. Here the water gushes down the cliff face for about 65 feet accumulating in a very clear fresh water pool. The area has plantations of banana, nutmeg and cocoa, Grenada's main export crops.

Significance of Area: The falls are notable geographic features which need to be maintained and enhanced. The high scenic and bathing qualities of the falls and their basins have contributed to the area being a traditionally popular recreation and picnic site. Additionally they are of great educational value for students with a keen interest in the natural processes of erosion and weathering.

Management Objectives: The area will be managed to protect the aesthetic and water quality of the waterfalls and pools. Planning and Management are also very critical in providing additional facilities and maintaining the level of satisfaction achieved by the visitor. The plantations of export crops should be maintained and tied into the tourist experience.

Activities: Enhancement of scenic quality through maintenance of pool side and trails.

Negotiate right of way through private property and work together with land owner on preparation of a management and development plan. Continue trail development and beautification. Develop environmental education programs which discuss geology, watershed management, multiple use and the agricultural export oriented drive of Grenada.

(iii) ANNANDALE FALLS

Location: Within the Beausejour River Valley west of Grand Etang lake.



Summary Description: Annandale waterfall was formed by the same process as explained in the case of the Concord Falls. This

natural landmark however is already established as a major recreation area and is one of the most accessible in the country. Two separate waterfalls are present where the water plunges approximately 30 feet into a fresh water pool where visitors picnic and swim. The adjacent lands are State owned and are recommended in this report as a multiple use area.

Significance of Area: The area is an important geographic feature which is a classic representation of a geological outcrop of the Tufton Hall Formation. This feature is to be protected and enhanced for public use both as an interpretation center and for recreational endeavours.

Activities: Once the renovation of buildings is completed, it will increase the quality of recreation attained at this landmark. It is also necessary to implement a management programme that would improve the aesthetics and provide interpretation activities to visitors. Environmental education programs should be developed to illustrate the importance of the multiple use areas surrounding the falls for agriculture, forestry, water quality, and recreation.

(iv) MARQUIS ISLAND

Location: Marquis Island is a small land mass located east of the Soubise point on the east coast of Grenada.

Summary Description: The Marquis Island and surrounding coral reef and eel grass marine ecosystems provide outstanding opportunities for recreation in a scenic environment. This area of geological interest was at one time part of the mainland. Ash layers formed by the volcanic eruptions as far away as the Grand Etang and Mount St. Catherine are visible.

Vegetation consists of the dry thorn scrub cactus environment referred to as the Deciduous Seasonal Formation. As farming once sporadically occurred on the island, there are remnants of an old foundation. In the drier, eastern section of the island

(*Sesuvium* sp.) and other ground succulents can be identified.

Significance of the Area: This area represents an excellent example of volcanic ash stratification as well as a place of interest for an afternoon tourism experience. Boats could be rented at Soubise and utilized to visit both Marquis Island and La Baye Rock.

Management Objectives: To provide protection to the natural features in order to encourage breeding and nesting of sea birds while providing opportunities for recreation and tourism.

Activities: Development of a landing dock and trail system to encourage tourism; implementation of a zoning plan in order to protect habitat for iguana and shore birds.

(v) RIVER SALLEE BOILING SPRING

Location: The boiling springs are located in the northeast of the Island approximately 1 and 1/2 miles north of Lake Antoine and south of Levera Pond.

Summary Description: The springs are located in the River Sallee area and occupy some 594 square meters of land with a surface made of soft porous volcanic sediments. There are approximately six (6) holes scattered within the area. The largest hole is approximately two (2) meters deep and five (5) meters in circumference filled with muddy brown water. The other holes are much smaller filled with very clean highly saline water, however orange yellow sulphur deposits are present in run off channels. The water temperature reaches approximately 35°C.

Significance of Area: The boiling springs are significant not only for their unique geology but also because it is an area of spiritual importance for the local residents. Members of the Baptist faith visit the area frequently to perform spiritual rituals and baptism. Visitors also throw coins into the fountain while they make a wish. The

feature is also significant because of its exceptional characteristic of highly saline acidic water more than one mile from the sea. It is possible that there is an association between the active kick-em-jenny marine volcano and the boiling spring.

Management Objectives: To protect the boiling springs of the area and provide opportunities for interpretation and further research. To provide easy access through trails and to clean up the area to improve the areas attractiveness.

Activities: Prepare a management and interpretation plan in association with the land owner. Clean up site and improve access.

(vi) HOG ISLAND

Location: Along the southern coast of the Island within the Woburn Bay.

Summary Description: Hog Island and surrounding coral reef and eel grass marine ecosystems provide outstanding representation of an island for the most part undisturbed by man. The island is thickly covered with *Acacia*, manchineel and *Leucaena* of the Deciduous Seasonal Formation. The Western coastline is covered with undisturbed mangrove forest while the eastern coastline is famous for the many shallow reefs and submerged platforms. The geology of the Island shows that it is primarily of sedimentary formation. A main fault lying in a north-west/south-east direction dissects the Island.

Significance of the Area: Hog Island is a volcanic representation of an undisturbed island ecosystem. With the exception of approximately fifteen (15) head of cattle introduced about two years ago, there is little evidence of man's activity. The Island is privately owned and trespassing strictly controlled.

The island is also significant for its aesthetic and recreational quality. A number of white sand sheltered beaches exist along

the coast. Many of these are protected by shallow reefs or occur interspersed within the mangrove.

Management Objectives: To protect the natural marine and terrestrial ecosystems in their undisturbed condition and to maintain the areas high quality recreational opportunities. Actions will be initiated to remove the introduced species from the Island in order to encourage nesting birds such as the brown booby and reptiles such as the iguana.

Activities: Preparation of a management and development plan in conjunction with the owner and other interested parties. Development of an environmental education program which discusses the vulcanism, the function of a caldera, and the evolution of a marsh ecosystem.

(vii) QUARANTINE POINT

Location: Between the Grand Anse and Morne Rouge Bay. A peninsula with an apparent east/west dissection.

Summary Description: Quarantine Point is an outstanding landmark in the south of Grenada between the Grand Anse and Morne Rouge bays. The area is of geological significance since it forms the rim of the most southerly crater lake on the Island. This crater, formed in geologically recent times, is associated with the many craters on the Island's north east. The peninsula shows very interesting rock stratification and is of outstanding beauty.

The vegetation on the peninsula consists of dry thorn scrub and cactus. The rocks are important nesting grounds for the many birds common to the south coast. The area was named during the late 19th century when leprosy was a major disease and the peninsula was used as a quarantine station to ensure that carriers of the disease did not enter the mainland.

Significance of the Area: The peninsula is of prime significance for its aesthetic and recreational quality. Quarantine Point is

located within the fast developing Grand Anse/Morne Rouge belt and requires urgent protection. Inappropriate development activity can lead to the loss of this scenic natural heritage resource. The point is easily accessible to the majority of the Grenadian population and would provide open space for recreation facilities as the pressures for use of the neighbouring beaches intensify. Since the point is visible from almost any point in St. George's it is critical that it is managed carefully so as not to destroy the interesting landscape.

Management Objectives: To maintain the interesting scenic and recreational qualities of the peninsula.

Activities: Designation of the peninsula as a natural landmark. Preparation of development plan outlining proposed uses. Develop facilities that would enhance scenic features and allow for increased recreational use.

(viii) LA BAYE ROCK - (Telescope Rock)

Location: Off Telescope point.

Summary Description: This small Island represents one of the few totally natural environments in Grenada. As a result, large iguanas and nesting brown boobies may be seen, as well as pristine dry thorn scrub forest. Coral reefs surround the Island.

Significance of the Area: The Island is an excellent example of animals interacting with an environment without the impacts of man. The island was formed in the Pleistocene geologic epoch.

Management Objectives: To protect the natural setting and initiate research into the fauna present on the Island and their status (nesting, breeding, roosting). To organize a boat tour which departs from Soubise and visits Marquis Island for a hike and La Baye Rock to view wildlife in an untouched state.

Activities: Development of environmental research programmes and tour visits which

tie into the islandwide environmental education program to be initiated in the school systems.

(ix) THE MARQUIS RIVER WATERFALL

Location: A 1/2 hour hike up the Marquis River from the southern main road, just south of the town of Marquis in the parish of St. David's.

Summary Description: The Marquis area is rich in cultural heritage sites such as the French church and weaving from wild pine in the town of Marquis, and the ruins of the Post Royal Military Fort. The Marquis River waterfall can be tied into an eventful outing with these other attractions such as the La Sagesse Protected Seascape.

The 1/2 hour hike to the waterfall following the Marquis River is highly scenic and presents several pools and interesting geologic formations. Agricultural crops are planted along the way and a wide diversity of wild fruit trees will seasonally provide the hiker with a refreshing snack.

Very little of the original dry forest type remains as much of the area has been converted to agriculture. The vegetation surrounding the falls is quite mature because of the constant humidity generated by the mist.

Significance of the Area: The area is highly scenic and provides a recreational opportunity for the town of Grenville, and a valuable tourist resource for the Country.

Management Objectives: To maintain or encourage a natural belt of vegetation - along the river, to develop a walking trail, and provide outdoor recreational opportunities.

Activities: Determination of boundaries along the river, preparation of a management and development plan, initiation of management activities. Design and implementation of a Eastern Main Road tour which leaves daily from hotels and tours the Southern zone of the Island. Points of

interest would include; The Tower C.L., the Bay Gardens, Westerhall Sugar Mill, La Sagesse Protected Seascape, Marquis Village, Marquis Island and La Baye Rock, and the Grand Etang Nature Centre.

PROTECTED SEASCAPES

(i) NORTH EAST SEASCAPE

Location: The North East Seascape protected area extends from the Telescope Rock to the south to the Bathway Beach to the north.

Summary Description: The North East Seascape extends for approximately six miles and is composed of magnificent cliffs, excellent wide sandy beaches, and patches of mangrove swamps.

From Telescope point northwards approximately two miles there is an excellent beach. Behind the high water mark is well developed windswept vegetation composed of coconut palms, almonds, and manchineel. Behind the Conference Bay there is approximately six acres of black and white mangroves however the outer fringe of this system has been severely damaged as a result of cropping for charcoal production. Cattle rearing has also caused a change in the vegetative association.

Between Conference Point and High Cliff point to the north is the Antoine Bay. The southern half of the coastline is occupied by a sandy beach while the northern half is strewned with rocks and boulders. Within the seascape one finds very outstanding cliff formations particularly the Bathway and High Cliffs.

The coastline is different to the others identified within this system plan since it is an open coastline exposed to the constant prevailing trade winds. As a consequence the surf is amplified resulting in heavy breakers and wide variation in water levels. Beach processes can easily be identified within the area. The magnificent beaches

are also important turtle nesting sites that are being increasingly mined for construction purposes.

Significant of the area: The area represents the most natural stretch of open beach and undisturbed picturesque cliffs in the country. Within it is a critical mangrove ecosystem that is slowly being degraded through exploitation for charcoal. The area is not only important for the nesting and feeding of birds, turtles and iguanas but also for research and environmental education and interpretation.

Activities: Co-operation with the few large landowners in the area. Preparation of a management and development plan, monitor and regulate critical activities including sand mining, turtle cropping, egg collection and charcoal production.

(ii) SOUTHERN SEASCAPE

Location: The protected seascape on the south coast is comprised of a number of units made of up of different points, inlets and bays. These include from east to west the lands immediately surrounding the Westerhall Bay, Chemin Bay, Egmont Harbour, west coast of Hog Island, eastern coastline of Mount Hartman Point, Canoe and Devil's Bay. The protected seascape also includes the southern most points and associated reefs of Point Egmont (including Adam Island), Fort Jeudy Point and Mount Hartman Point.

Summary Description: The area is well known for its scenic value and outstanding fisheries and recreational resources. The areas chosen as protected seascape includes mainly well developed highly productive mangrove coastlines. These are located in well sheltered inlets that are not easily accessible by roadway. The main species is the red mangrove *Rhizophora mangle* which provides habitat for many commercially important species such as lobster, queen conch and oysters. These also form nesting ground for many important bird species.



Boatbuilders of Soubise on the Windward side of Grenada stand proudly by their hand-fashioned vessel.

species within the area are increasingly becoming scarce. Fishermen claim that the distance from shoreline to where the finfish, conch, and lobsters are harvested is increasing.

The southern most points of the Islands and Egmont Point have very interesting reefs and eel-grass beds that form important breakwaters and fish feeding areas. These are of both geological and scenic interest. Canoe and Devil's bays are also interesting seascapes since they form beautiful beaches and are also two of the very few areas on the south coast where iguanas are still readily seen.

Significance of Areas: The southern coast seascape represents the indented truncated coastline common to the Island of Grenada. Within the inlets are outstanding examples of mangrove ecosystems. The southern coastal waters are the most productive commercial aquatic species such as lobster and conch. The mangroves ecosystems support this marine life by producing organic matter and habitat for aquatic micro-organisms. It is therefore critical that remaining mangrove

species be protected to support commercial fisheries operations.

There is an abundance of oysters within the mangrove system, which have not been exploited since it is not one of the traditional species collected by the people in the area. This gives the area increased significance since it allows the opportunity for managed harvesting and production.

The reefs to the south of peninsula are also significant as they are the habitat for many other commercial species. Presently there is extensive use of pots and traps on those reefs.

The landscapes are also important because they demonstrate geological and geomorphological processes such as volcanic activity, subsidence, uplift and wave and wind action.

It is an important recreational and educational resource that is within easy reach of 40% of the country's population.

Management Objectives: to protect the mangrove ecosystem and the important reefs within the area. To provide opportunities

for environmental education, research and recreation and to manage and regulate exploitation of the traditional fishing grounds.

Activities: Development of a management plan; initiate a programme of environment education and institutionalize a monitoring system which prohibits the use of traps which are not biodegradable.

(iii) LA SAGESSE

Location: At the Estuary of the La Sagesse River within the La Sagesse Bay.

Summary Description: La Sagesse comprises a mangrove estuary, a salt pond, 3 beautiful beaches, interesting geological formations, coral reefs, and excellent examples of littoral woodland and thorn scrub cactus woodland.

Significance of the Area: The area has a diverse assemblage of ecosystems in a small area providing outstanding wildlife habitat for migratory birds and waterfowl. It is a favorite spot for weekend outings for the local population.

Management Objectives: To protect the ecosystems in a natural state and promote programs of education and recreation.

Activities: Develop an environmental education program for the local population and tourists. Ensure protection of the salt pond, mangrove estuary, and freshwater marsh. Prohibit sandmining and any inappropriate development.

(iv) MOLINERE REEF

Location: The Molinere Reef Protected Seascape is 5 kilometers north of St. George's on the Leeward on Western side of the island.

Summary Description: The area consists of a series of coral reefs and sea fans beds. The terrestrial part is represented by seasonal deciduous forest which provides a natural backdrop to the marine ecosystem. The Molinere Reefs forms part of an

extensive recreational tourist complex on the island. There is a wide diversity of life forms on this outstanding reef, considered to be the best reef off the island of Grenada.

Panoramic views can be had of the mainland from moving boats, and small private beach provides an outstanding area for nature enjoyment, relaxation, and snorkeling. The area has excellent qualities for the development of a variety of educational and recreational opportunities.

Significance of the area: The Molinere Reef represents the finest coral reefs off the mainland of Grenada. Only 20 minutes by boat from St. George's Harbour, the area is frequented by scuba and skin diving enterprises which bring visitors to the area. The area has been protected from exploitation by man by the local divers. As a result, lobsters are prevalent as are both soft and hard corals. A wreck with a steel hull is seen at 80 feet below sea level which harbours beautiful reef fishes and is beginning to be colonized by various species of coral.

Management Objectives: To protect and maintain the Molinere Bay ecosystem and its outstanding natural features and to provide opportunities for recreation interpretation research and environmental education.

Activities: Formation of a management committee with the local divers, fishermen, and Fisheries officers, protection of the marine areas by controlling visitors and enforcement of regulations.

CULTURAL LANDMARKS

(i) RIVER ANTOINE RUM DISTILLERY

Location: One (1) mile to the south east of the Lake Antoine crater in the north east of the island.

Summary Description: The River Antoine Rum Distillery is located on the River Antoine estate which is owned and operated by the DeGale family. The Distillery is a