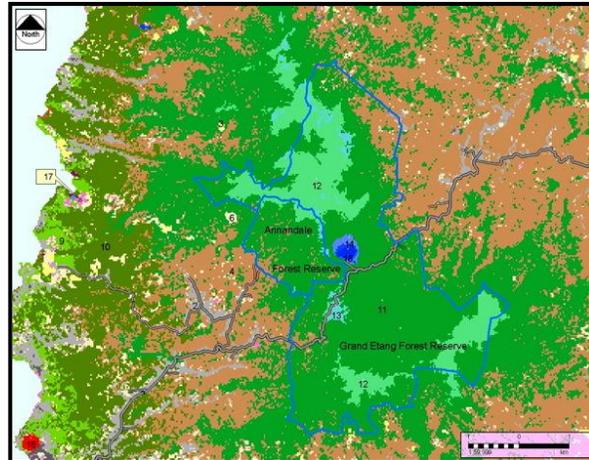


ENVIRONMENTAL AND SOCIOECONOMIC BASELINE STUDIES

Grenada Site Report

for

Grand Etang and Annandale Forest Reserves



Prepared for:

The OECS Protected Areas and Associated Livelihoods (OPAAL) Project



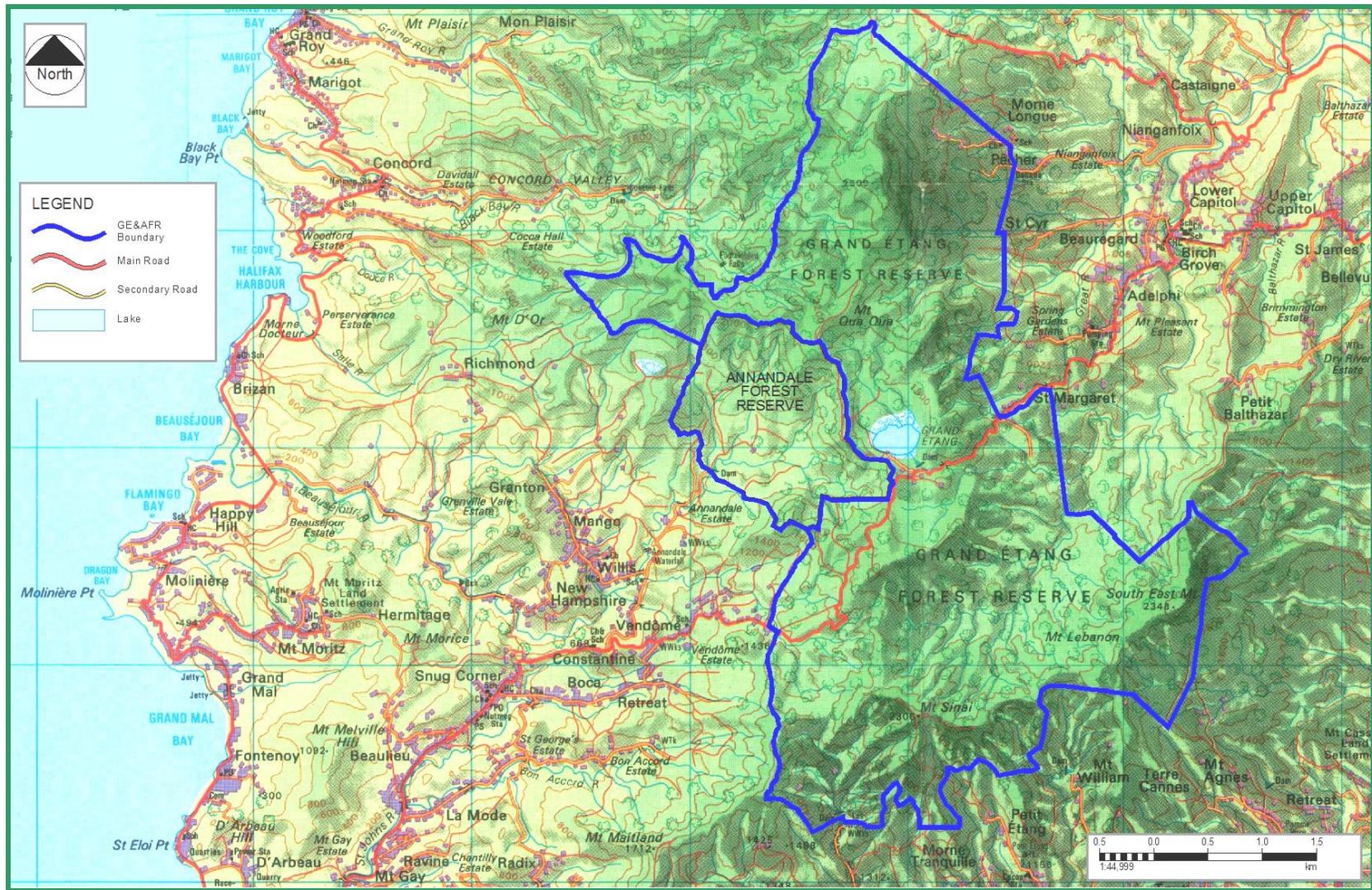
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6 June 2011



Topographic Map of Central Grenada showing approximate boundaries of the Grand Etang and Annandale Forest Reserves.
 (Based on D.O.S 1:50,000 Topographic Map – Government of Grenada, 1992)

Acknowledgements

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This report on the baseline environmental and socio-economic studies of the Grand Etang and Annandale Forest Reserves, which together form the demonstration site for the OECS Protected Areas and Associated Livelihoods Project in Grenada, has benefited from several prior studies and reports which have been acknowledged and documented in the text and in the References section. In particular, the authors would like to mention Lloyd Gardner's *Comparative Analysis for Development of a Harmonised Protected Areas Management Framework within the OECS*, which was completed in January 2007, and the *Management Plan for the GE&AFR*, produced by Mel Turner in August, 2007. Both documents provided useful baseline information and thoughtful analysis.

Many other persons contributed to the gathering of information and its interpretation. In particular, the Chief Forestry Officer and head of the NICE, Aden Forteau, and Anthony Jeremiah, Forest Conservation Officer and OPAAL National Project Coordinator, were very helpful in facilitating meetings, providing transport and assigning Forest Officers to accompany the field team on their demanding schedules for collection of plants and other information, bat surveys and other field work, as well as obtaining maps and the necessary documentation for off-island shipment of specimens for identification. Thanks are also due to the group of Forest Officers who willingly accompanied the field team on their surveys and provided useful local information and guidance.

Other members of the Ministry of Agriculture, including the Chief Agricultural Officer, Daniel Lewis and the Head of the Land Use Department, Raymond Baptiste, provided willing assistance in procuring GIS data and more general information about the work of the Ministry.

The many persons who willingly gave of their time to be interviewed by the socio-economic team must also be thanked for their contribution to the data gathering and interpretation. These have been listed elsewhere in the document. In particular, the team would like to thank the several individuals who provided personal descriptions and observations of their relationship with the forest and their thoughts on how these relationships could become more sustainable and supporting.

The help of our Local Partner, Tyrone Buckmire, was invaluable in suggesting persons and organisations to meet and in arranging these meetings as well as by providing access to documents and reports, laws and other reference material—a process which went on long after our on-site visit.

Finally, the assistance of the OECS Environment and Sustainable Development Unit in St. Lucia must be acknowledged for their support in providing guidance, project documents, and helpful comments on the draft reports.

We know that the process of developing a functional system of protected areas to conserve the wonderful biodiversity which Grenada possesses is just beginning, and much work remains to be done. However, we hope that this report will provide some useful help in guiding the thinking and assessing the options, as the work the OPAAL Project goes forward.

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List of Acronyms and Abbreviations

AFR.....	Annandale Forest Reserve
BoT.....	Board of Tourism
CBD	Convention on Biological Diversity
CBO	Community-based Organisation
DFNP	Department of Forestry and National Parks
ESDU	Environment and Sustainable Development Unit
FFEM	Fonds Français pour l'Environnement Mondial
GEF	Global Environment Facility
GEFR.....	Grand Etang Forest Reserve
GE&AFR.....	Grand Etang & Annandale Forest Reserves
GIS	Geographical Information System
GLISPA.....	Global Island Partnership
GPS	Global Positioning System
IRF	Island Resources Foundation
IUCN	The World Conservation Union
MAFF.....	Ministry of Agriculture, Forestry and Fisheries
MEA	Multi-lateral Environmental Agreement
MoT.....	Ministry of Tourism
MPA	Marine Protected Area
NAWASA.....	National Water and Sewerage Authority
NEMMA	North East Marine Management Area
NICE.....	National Implementation Coordinating Entity
NPC	National Project Coordinator
NTAC	National Technical Advisory Committee
NGO.....	Non-governmental Organisation
OAS	Organisation of American States
OECS	Organisation of Eastern Caribbean States
OPAAL	OECS Protected Areas and Associated Livelihoods (Project)
PA	Protected Area
PMS	Participating Member State
PSC	Project Steering Committee
SIE	Site Implementing Entity
SMMA.....	Soufriere Marine Management Area
SPAW	Specially Protected Areas and Wildlife (Protocol)
TOR	Terms of Reference
TNC	The Nature Conservancy
UNEP.....	United Nations Environment Programme
UNDP.....	United Nations Development Programme

PART I

INTRODUCTION and BACKGROUND to BASELINE STUDIES

I/1. Overview

I/1.1. The OPAAL Project

The OECS Secretariat through its Environment and Sustainable Development Unit (ESDU) began implementation of the OECS Protected Areas and Associated Livelihoods (OPAAL) Project in December 2004. The regional project is a partnership with the International Bank for Reconstruction and Development (the World Bank) acting as an Implementing Agency of the Global Environment Fund (GEF); the Fond Français de l'Environnement Mondial (FFEM) of the Government of France; and the Organisation of American States (OAS), and with the 6 participating countries of the OECS. The project seeks to address the major problems that these participating countries face in developing an effective system of Protected Areas (PAs) as an important component of their biodiversity conservation strategy which they are required to do as signatories to the Convention on Biodiversity (CBD).

The project addresses a number of issues with respect to the establishment, funding and management of PAs through a number of different components. Component 1 deals with facilitating a more effective institutional framework for conservation management through providing a critical focus on the existing natural resources, legal and institutional frameworks to promote conservation and protected area establishment and management. As such, the project aims to facilitate a harmonized approach to the creation and management of protected areas in the OECS region.

Component 2 deals with Protected Areas Management and Associated Livelihoods. The component's objective is to promote biodiversity management and conservation through the establishment of new and the strengthening of existing protected areas, complemented by support for expanded, alternative and/or new livelihoods in areas surrounding the respective PAs.

As part of the component, environmental and socio-economic baseline studies for OPAAL demonstration sites are being implemented, for which Island Resources Foundation (IRF) has been contracted by the OECS to carry out such studies in Grenada.

I/1.1.1. Demonstration Sites for Grenada: The Grand Etang and Annandale Forest Reserves

Each OPAAL participating country was required to propose a demonstration site where practical solutions to the issues mentioned above would be developed within a comprehensive and orderly framework. The selected site had to be officially declared as a legally protected area to qualify for inclusion in the project. This involved a process of consultation and discussion among government agencies, non-government organizations and private sector groups all of whom had an involvement as interested stakeholders.

Largely as a result of the OPAAL initiative and the ensuing discussions to choose a suitable site in Grenada, the two adjacent forest reserves of Grand Etang and Annandale are being considered together to form the Grand Etang and Annandale Forest Reserves National Park, although this legal status has not yet been declared

I/1.1.1.1. Origins of the Grand Etang Forest Reserve

The Grand Etang Forest Reserve (GEFR) has been in existence for over 100 years and was established by the *Grand Etang Forest Reserve Act* of 1906. The Act specified that the Reserve was “to provide for the preservation of forest growth” and recognised that “it is of vital importance for the conservation and promotion of rainfall and water supply of the island”. This was in keeping with other legislation concerning watershed protection issues that was enacted around the same time in other Eastern Caribbean islands (IRF, 2011b). The Act also was careful to state that this declaration was to be considered permanent by declaring that “All the lands aforesaid shall for ever hereafter form part of Government land and shall be strictly reserved and set apart for the public purposes of forest conservation”.

Two decades later, the 1928 *Wild Birds and Animals Sanctuary Act* established the Grand Etang Forest Reserve as a “sanctuary for wild animals and birds”. The Forest Reserve is also subject to the *Forest, Soil and Water Conservation Act* and the *Birds and Other Wildlife (Protection) Act*.

It is clear therefore that the primary purposes for the Reserve were to protect the forest and its associated ecosystems and, in so doing, to help protect the water supply for the island. This is significant as the Grand Etang Forest Reserve (GEFR) is the closest forested area to the main economic centre in St George’s, the capital city of the country. It also is bisected by the main road connecting St George’s with the second largest town of Grenville.

Although the Reserve has been managed over the last 100 years, generally in pursuit of watershed management objectives, and numerous studies and reports have been conducted and prepared, the Reserve has never had an approved management plan.

I/1.1.1.2. Origins of the Annandale Forest Reserve

The lands comprising the Annandale Forest Reserve (AFR) occupy the south western border of the GEFR and also form an important part the head waters of the Beausejour River. They formed part of the Annandale Estate before being acquired by the Government

in the 1970s, but continued to be used for some extraction of forest products, for tree crop agriculture, mostly cocoa and nutmeg, and as an important source of water for the public water supply. The lands were managed by the Forestry Department but were not legally protected until a Forest Reserve was established in 2006 by government decree and legally gazetted.

Management of the area now occupied by the Annandale Forest Reserve has been the responsibility of the Department of Forestry and National Parks (DFNP) of the Ministry of Agriculture, Forestry and Fisheries (MAFF). There have been a number of previous approaches to the management of the area, including preparation of a draft management plan produced in the mid 1980s; the plan addressed issues of reforestation, crop rehabilitation, road maintenance, infrastructure establishment, hydrology, monitoring, training and supervision. This was followed by a new working draft of the management plan, prepared by the Department in 2002. However, the passage of Hurricane Ivan in 2004, and the subsequent damage caused by this storm interrupted its approval. Further work on the draft plan occurred in 2006 when a workshop was held to review and update the draft plan, including consideration of how to stimulate the livelihoods of adjacent communities.

/1.1.1.3. Importance of the Grand Etang and Annandale Forest Reserves

The Grand Etang and Annandale Forest Reserves (GEAFR) occupy much of the high rainfall areas close to the capital St George's and the heavily populated areas surrounding the city. These areas include some of the most important concentrations of tourism infrastructure and industrial/commercial activity on the island, as well as important educational establishments.

This concentration of activity and population requires a reliable and adequate supply of potable water. In addition, such concentration increases the threat of gradual encroachment on watershed areas from expansion of the St. George's urban centre and its surrounding environs. Therefore, the declaration of Annandale and Grand Etang as forest reserves provides a certain amount of protection for the forest habitat and its associated watershed services upon which the island depend. The importance of the reserves increases the need for a well-developed and effectively implemented management plan for the Grand Etang and Annandale Forest Reserves (GE&AFR), including the development of clear lines of authority for management of the reserves. Extant legislation does not assign such responsibility, although the Forestry Department of the Ministry of Agriculture has carried out that role for several decades.

It should also be noted that several of the communities surrounding the reserves are dependent on the forests, its waterfalls and other scenic attributes for a significant number of livelihoods associated with providing services for visitors—whether local, regional or from further afield, who come to the GE&AFR to enjoy these natural features.

I/1.1.1.4. Vision for the Grand Etang and Annandale Forest Reserves

The IRF team was not made aware of any documented and specific vision for the GE&AFR, except for the one provided by the recent management plan, prepared by Mel Turner as part of the OPAAL project (Turner, 2007). This vision states that:

The Grand Etang and Annandale Forest Reserves will contribute directly to the livelihoods of most Grenadians as the Reserves are, and will continue to be, the water supply for Grenada. Although management of the use and resources of the Forest Reserves will be based on watershed protection and maintaining water quality, compatible uses associated with this exceptional tropical rainforest such as recreation, tourism, education, biodiversity conservation and production of timber and non-timber forest products will be encouraged where appropriate and strengthened by land designation; all in an effort to sustain livelihoods in local communities and contribute to the environmental, social and economic goals of Grenada.

Turner (2007) states that this vision statement is in keeping with Grenada's approved Forest Policy, the Forestry and National Parks Department's Strategic Plan, the National Environmental Policy and the National Biological Diversity Strategy and Action Plan.

Discussions with various stakeholders indicated a similar vision for the GE&AFR as a multi-use, national park-type protected area that will both protect the reserves' biological and hydrological assets, while also providing increased opportunities for establishing significant livelihoods in the GE&AFR and— perhaps, more especially —in the surrounding communities.

I/1.1.2. Development of Other Protected Areas (PAs) in Grenada

Currently, the main island of Grenada has five terrestrial areas that have been declared as protected areas. These comprise two Forest Reserves (Grand Etang and Annandale), two National Parks/Protected areas (Perseverance Protected Area and Mt Hartman Protected Area) and one archaeological preservation area on unspecified Crown Land at Pearls, which was established under the National Heritage Protection Act as a PA for Amerindian artefacts. There are also two marine protected areas that have been declared under fisheries legislation at Woburn/Clark's Court Bay and at Moliniere/Beausejour. A number of other areas have been proposed and are under consideration, and some have been accepted by Cabinet but are not yet properly described or gazetted.

The Grand Etang Forest Reserve, despite its long history, has never had a comprehensive management plan. However, a draft management plan for the Annandale Forest Reserve was prepared in 1985. This was revised in 2002 with considerable community input. However, implementation of that plan was disrupted by the advent of Hurricane Ivan in 2004. In 2007, under the OPAAL project, a management plan for the two forest reserves was prepared, treating them as one unit.

At present, apart from the GE&AFR National Park, each protected area is managed separately, though the Forestry and National Parks Department generally has the major role in overseeing and implementing protected area management programmes.

I/1.2. Need for A Systematic Approach to PA Development

More recently, it has been recognised that piecemeal development of protected areas without an overall plan for their management and further growth is not only wasteful in terms of human and financial resources, but likely will not result in optimum protection of a nation's biodiversity, as important species and ecosystems may be missed, while some ecosystems may become over-represented (Gardner, 2007). This piecemeal approach also makes it difficult to prioritise certain sites for immediate action and to designate other areas of a lesser concern in the short-term. Therefore, the role of the GE&AFR in the context of a national protected areas system for Grenada needs to be carefully analysed, as—given its size—it is likely to play a dominant role in any fully developed national park system.

1/2. Site Description and Context

1/2.1. Location and Extent

The Grand Etang and Annandale Forest Reserves are located in the interior of Grenada in the South Central Mountains of the island. Both Reserves are intimately connected, with Annandale Forest Reserve situated on the south western boundary of Grand Etang Forest Reserve. The Grand Etang Forest Reserve is situated on the St. George's-Grenville road which more or less bisects the GEFRR passing close to the Grand Etang Lake. The GEFRR occupies an area of 1700 hectares (4200 acres) and the Annandale Forest Reserve (AFR) is considerably smaller, occupying approximately 240 ha (590 acres).

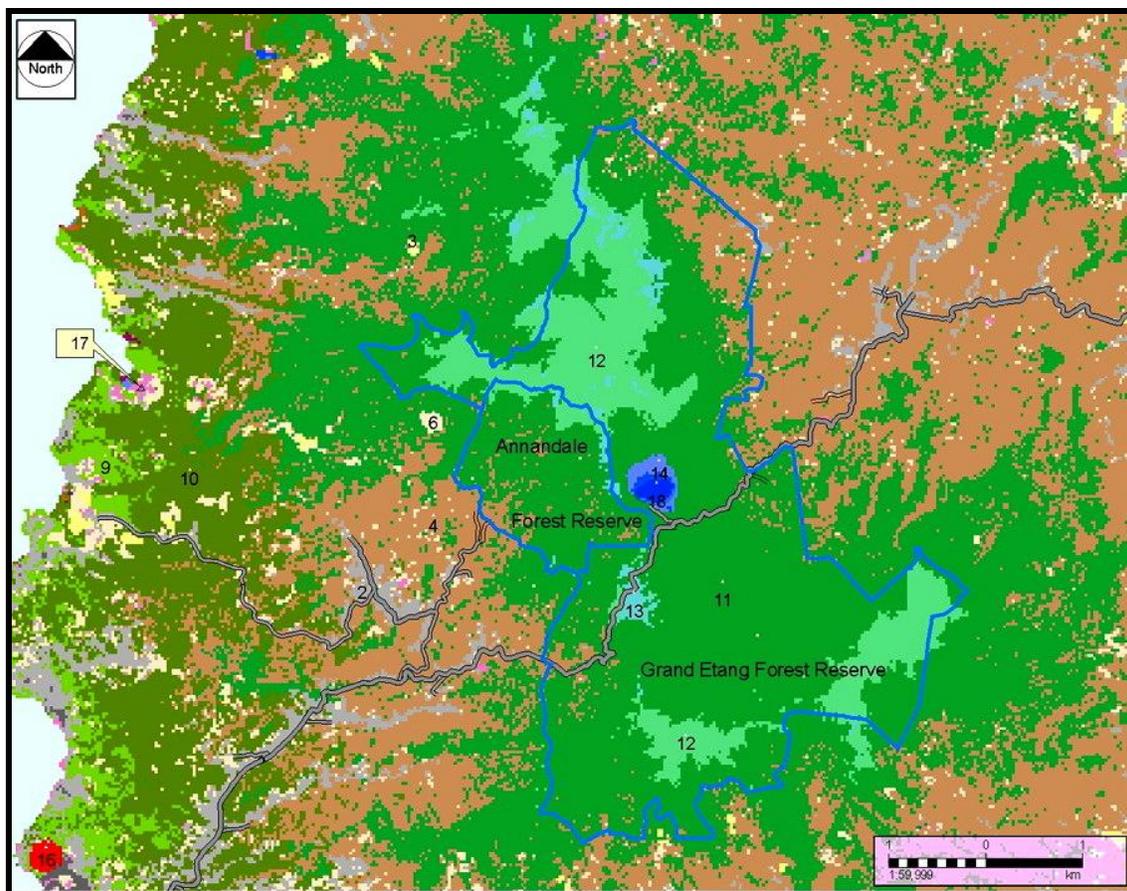


Figure 1. IITF land cover (Helmer, *et al.*, 2008) and GE&AFR boundaries¹.

¹ Note that this map is based on secondary sources, most notably the maps of Caribbean Protected Areas assembled by The Nature Conservancy. The results seem reasonable, but the IRF team has *not* been able to confirm the boundaries of the two reserves from official Government sources.

Grand Etang is situated just over 4 km northeast of the island's capital St. George's, and Annandale about 4.5 km to the north. Grand Etang Forest Reserve is bisected by the island's main cross-island road, joining the two main cities of St. George's and Grenville. The Forest Reserves have elevations ranging between 250 and 760 m above sea level.

1/2.2. Physical Description of the Forest Reserves

1/2.2.1. Geology and Soils

The most comprehensive survey and classification of the soils of Grenada was done by Vernon, *et al* in 1959. A summary of the team's results, as well as other researchers is provided in the *Grenada Environmental Profile* (CEP) of 1991. For a comprehensive overview of the geology of Grenada, including the areas of the Grand Etang and Annandale, consult Martin-Kaye (1958), Jackson (1970), Arculus (1976) and the condensed summary of these findings in the *Grenada Country Environmental Profile* (IRF, 1991). A brief summary of the geology and soil characteristics of Grand Etang and Annandale are provided here.

The geologic history and evolution of Grand Etang and Annandale date back to as far as the Pliocene Period (5 to 2 million years ago) and continued into the Pleistocene Period (2 to 0.1 million years ago). From the Pliocene to the Pleistocene, the island experienced its most violent volcanic activities and most intense and extensive mountain building. Grand Etang (French for Big Lake) was formed in the island's most recent stage of volcanic activity, and is described as an explosion crater (crater is formed when material is ejected from the ground by a violent and explosive event). Many of the peaks, ridges and slopes of both Grand Etang, and to a much lesser extent, Annandale, are formed of andesitic dome summits, which in many areas are covered and characterised by the extrusion of basaltic lava. Much of Annandale sits on reworked volcanics. The Grand Etang crater lake is itself underlain by scoria and ash deposits.

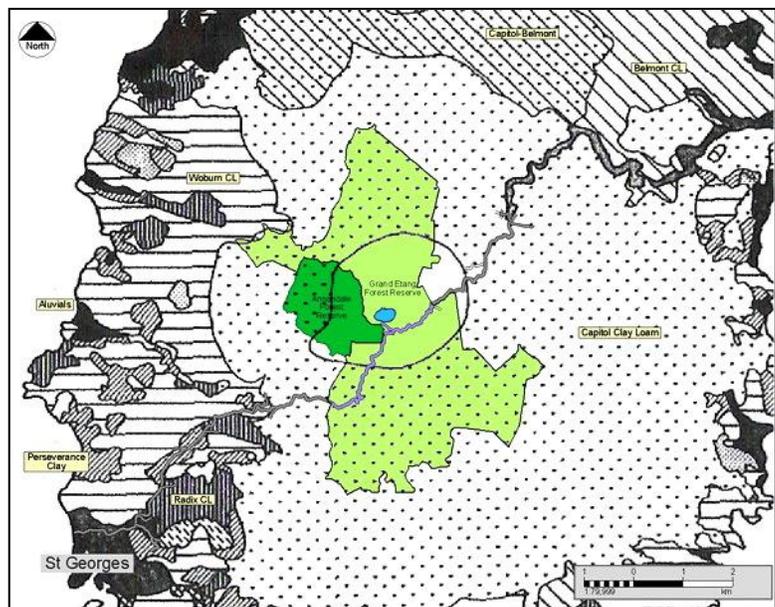


Figure 2.
Soils of the GE&AFR, mapped in Vernon, 1959.

While the area has not been active since the European colonization, several streams rich in iron and sulphurous minerals are found within the boundary of the GE&AFR (*pers observation*, B. Cooper, IRF Study Team, February 2011).

Soils within the Forest Reserves were primarily the result of local climate, topography, drainage conditions and type of underlying bedrock. Most soil types consist primarily of Capitol Clay Loam and Belmont Clay Loam. The former is a brick-red, well weathered “latosol” which usually occurs over the highly weathered basic igneous rocks. The latter is a brown earth “latosol”, usually occurring over basic ash and agglomerate. Both soils are moderately to well drained, with good water retention. Belmont Clay Loam is however moderately erodible when it occurs on the less extreme slopes. Strict conservation measures are advisable in most areas of Capitol Clay Loam (Vernon, *et al.*, 1959). (See Figure 2 for the best current soils map of the area).

Both soils are mainly used for nutmeg, cocoa, bananas, and food crops. Belmont Clay Loam has the greater natural fertility when found on gentle slopes.

Steep slopes are susceptible to pronounced erosion and mass wasting, as evidenced by the many slide scars along the ridge lines. Land sloping over 30 degrees should never be cleared of its natural vegetation and areas between 20 and 30 degrees are extremely susceptible to erosion (Vernon, *et al.*, 1959).

I/2.2.2. Topography

The Forest Reserves range in elevation between 250m and 760m (approximately 800ft to 2,500ft) above sea level. The GE&AFR includes four of Grenada’s highest mountains: Mount Sinai (700m), Southeast Mountain (712m), Mount Qua Qua (713m) and an “unnamed peak” (760m). The mountains have been incised by the many rivers and streams resulting from heavy rainfall, and this gives rise to a very complex topography with many valleys and ridges, separated by steep slopes, some as steep as 20° to >30°.

I/2.2.3. Rainfall and Other Climatic Factors

Grenada experiences a humid tropical marine climate, and, like the rest of the Lesser Antilles, with fairly constant trade winds out of the east and northeast. This general description of the island’s weather and climatic conditions, however, does not accurately reflect those at the higher elevations at Grand Etang and Annandale. Given the elevations of the Reserves above 250 metres, temperatures are moderate, averaging 70°F (21° C), and in the months from December to March, nightly temperatures may fall well below this average. This gives rise to periods of mist and fog, thereby reaching humidity of 100%.

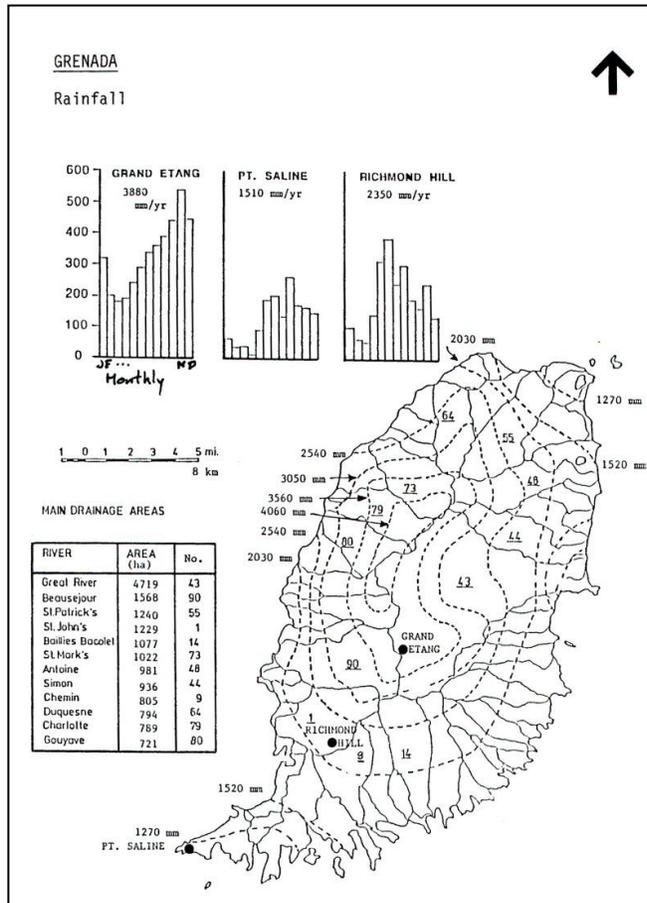


Figure 3. Combined rainfall statistics and watersheds (IRF, 1991, p .73).

The uplift of the moisture laden trade winds as they flow over these mountains and the resulting cooling gives rise to high levels of precipitation. Annual rainfall totals within the forest reserves range from 2800mm to over 4000 mm (110 to 160 inches) with the wettest months being June to November. This level of annual precipitation gives rise to very humid conditions and the resulting run-off feeds many small streams, some draining to the east and feeding the Great River and others, especially in the Annandale Forest Reserve, feeding the Beausejour River. In general, on the eastern (windward) side of the mountains, higher levels of rainfall and humidity occur with rainfall reaching a maximum of 4,000 mm at Grand Etang and Mount Qua Qua, while the western or leeward side receives less rainfall—between 2,500 and 4,000 mm. (See also Figure 3.)

the interaction of local factors creates a range of micro-climatic conditions within the GE&AFR, which enable it to support a rich collection of specifically adapted biodiversity.

The complex nature of the peaks of the central highland areas of Grenada and

1/2.2.4. Drainage and Watersheds

Both Forest Reserves are critical areas for water supply for the local community. Grand Etang in particular is the upper headwaters of some 10 steep-sided valleys, and the upper basin and recharge area of a major tributary of Great River and Black Bay River. The Annandale Forest Reserve includes the headwaters of a major tributary of the Beausejour River.

According to Weaver (1989) and GOG (1988), there are at least four important catchments used to provide public water supplies within and proximate to the Forest Reserves. They include the “high-density” forestry zone in Great River Watershed, Les Avocats catchment, Annandale catchment and Concord catchment.

In all, the GE&AFR area is the headwaters for ten watersheds. NAWASA, the National Water and Sewerage Authority, has developed four catchments in the GE&AFR to provide public water supplies to both the east and west side of Grenada. The area is therefore a very important source of potable water for the commercial and residential centre in and around the capital city of St George's as well as the several rural communities on the periphery of the GE&AFR.

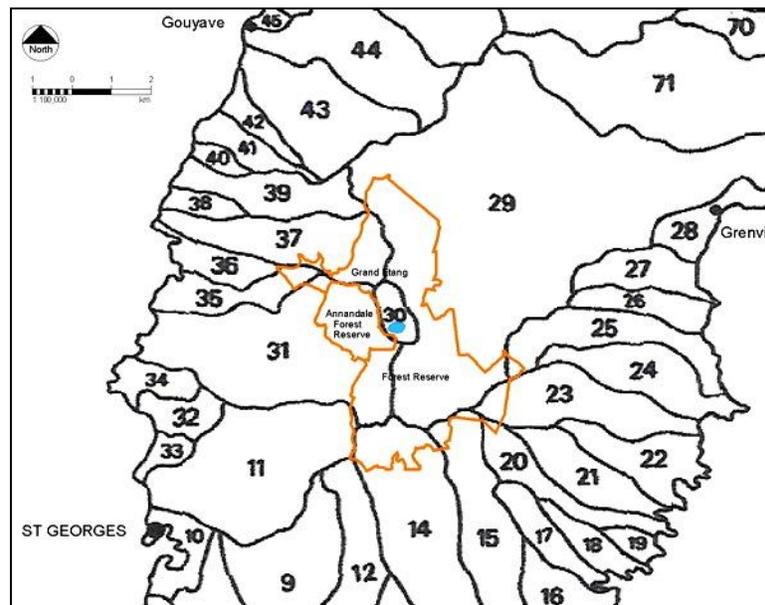


Figure 4. Watersheds in Grand Etang and Annandale Reserves.

In recent years observers have noted that the Grand Etang Lake surface area has been shrinking, as evidenced by vegetation, comprised mostly of freshwater species, encroaching along the perimeter. This is occurring despite a 5.5 foot dam that has been installed to increase the volume of the lake as a reservoir. Sediment runoff into the lake is also a contributing factor. Because of the importance of the Forest Reserves' water resources to domestic supplies in Grenada, this issue needs investigation.

1/2.2.5. Cultural Setting

The Reserves are surrounded by several communities outside their perimeters. Annandale and Vendome occur along the southwest border; Les Avocats and Petit Etang along the southern border, and St. Cyr, Pecher, and Birch Grove to the north and northeast of Grand Etang Reserve. The closest community to Grand Etang Forest Reserve is Les Avocats and Annandale is the closest to Annandale Forest Reserve. There are no urban centres within the reserves, and very few people reside within the boundaries.

Communications within the reserves are served primarily by unpaved roads or tracks, mostly just grassed, and footpaths. Paved roads are generally exterior to the boundary of the reserves except where access to water catchments or other facilities is required on a

regular basis for maintenance, etc. Minor roads serve the various surrounding communities and a major, though often quite narrow, road connecting St George's with Grenville and other communities to the north and northwest runs right through the middle of the Grand Etang Forest Reserve, passing close to the lake itself.



Figure 5. Map of central Grenada showing Grenville Road and nearby communities.

I/3. Summary of Primary Findings

I/3.1. Environmental Conditions and Assets

Part II of this Site Study for the Grand Etang and Annandale Forest Reserves provides a thorough discussion of the procedures and methodologies employed by the IRF team in carrying out the environmental site study as well as the key findings and recommendations from the team based on their research and field investigations. We present here, in the introductory section of our report, a summation of those key findings, which, as noted, are enlarged upon in Part II.

I/3.1.1. Primary Findings of Environmental Assessment—Plant Biodiversity

I/3.1.1.1. Vegetation Communities

The two Forest Reserves contained a total of 18 vegetation communities distributed as shown in Table 1 below. All 18 were found in the GEFR, and only 11 were located in the AFR.

Table 1.
Distribution of Vegetation Communities Found in Grand Etang and Annandale Forest Reserves.

Vegetation Community (IITF Classification system)	Presence		Notes
	GEFR	AFR	
Seasonal Forest	*	*	
Evergreen Forest/Sierra Palm Forest	*	*	
Sierra Palm	*		
Elfin Woodland	*		
Broad-leaved Evergreen Woodland	*	*	
Grassland with Sparse Broad-leaved Evergreen Tree Layer	*	*	
Steep Non-forest Vegetation	*	*	
Freshwater Wetland	*		
Aquatic/Water – Permanent	*	*	
Pasture	*	*	
Cultivation – Herbaceous / Cultivated Lands	*	*	
Cultivation – Tree Crop/	*	*	Includes Mixed & Woody Agric. / Coconut Palm with Pasture
Rural/Built	*	*	
Bare Soil	*	*	This may include landslips and slides, exposed banks along streams, rivers and ghauts, and communities with vegetation cover of 10% or less

I/3.1.1.2. Flora

The floristic composition was identified provisionally as shown in Table 2 below.

Table 2. Floristic Composition of the GE&AFR.

Biodiversity	Count
Total No. of Spp	441
Plant Type (No of Species)	
Trees	130
Shrubs	62
Vines	53
Herbs	196
Families	116
Invasives (Spp)	2
Introduced (Spp)	27

Several previously unreported species of plants were found during the field surveys. The information is summarised in Table 3 below, and details are given in Part II of this report.

Table 3. Summary of New Records Found at the GE&AFR, January 2011.

Species Name	Family	Notes
<i>Dioscorea cf. altissima</i>	<i>Dioscoreaceae</i>	Widespread throughout mountainous islands of the Lesser Antilles — found to be common throughout the forests of Grand Etang.
<i>Miconia cf. furfurcea</i> .	<i>Melastomataceae</i>	The identification of this species is tentative and alternatively, may represent an unknown <i>Tetrazgia</i>
<i>Siparuna sp</i>	<i>Monimiaceae</i>	This is a new record for the island. The identification is tentative. The closest possible species is <i>Siparuna glabrescens</i> , (endemic to the Windward Islands). Needs work to identify definitively.
<i>Epidendrum fragrans</i>	<i>Orchidaceae</i>	This orchid is widespread through much of the Lesser Antilles and South America, but was not previously reported for Grenada. Common in the forest of Annandale Forest Reserve.
<i>Triphora surinamensi</i>	<i>Orchidaceae</i>	This inconspicuous member of the orchid family was not previously reported. It was found growing at the base of a bamboo clump beside the track in Annandale FR.
<i>Cissus obovata</i>	<i>Vitaceae</i>	This species has not been previously reported for Grenada — West Indian endemic

The examples listed above demonstrate that even a brief visit to fairly well-known areas in the two Reserves, such as those visited by the IRF team in January 2011, can yield new records and, possibly, even new species. It also indicates that the island's flora is not yet well studied or well understood. It is likely that many more important discoveries remain to be made, and this is critical if authorities are going to manage the island's biodiversity effectively. Additionally, given that some of these species are still unknown, further studies are needed to establish their taxonomic status and thus their conservation needs.

I/3.1.1.3. Plant Species of Special Conservation Concern

The species listed in Table 3 above are "of conservation concern" because they are new records and therefore their conservation status is still unknown. Additionally, there are two *known* species of conservation concern described in Table 4 below.

Table 4. Known Species of Conservation Concern.

Species Name	Family	Notes
<i>Maytenus grenadensis</i>	<i>Celastraceae</i>	This species is one of a handful of plants endemic to Grenada. It is relatively widespread in Grand Etang and other montane areas.
<i>Vismia sp</i>	<i>Clusiaceae</i>	This species was first recorded by Hawthorne <i>et al</i> in 2003. Its taxonomy is unclear. It is found in the Grand Etang Reserve and scattered montane areas of the island. Its conservation status is unclear.

I/3.1.1.4. Invasive Plant Species

There are four invasive plant species that have become established in both Reserves. These include the Bamboo (*Bambusa vulgaris*), Kudzu (*Pueraria phaseoloides*) and Wild Hops (*Flemingia strobilifera*), all introductions from Asia, and the Blue (Mountain) Mahoe (*Talipariti elatus*), originally from Jamaica. More details of these species are provided in Part II of this report.

I/3.1.2. Primary Findings of Environmental Assessment—Fauna

I/3.1.2.1. Faunal Biodiversity

Table 5. Species Numbers for Fauna of Grand Etang and Annandale Forest Reserves.

Biodiversity/Species Name	Count	Notes
Birds	>75	Includes several regional endemics plus
Mammals	>23	Includes 14 species of Bats
Amphibians and Reptiles	~16	Includes one endemic snake (<i>Typhlops tasymicris</i>) and one endemic frog the Grenada Ditch Frog (<i>P. euphronides</i>),
Fish	Unknown	Data on fish was not encountered during investigations in Grenada
Invertebrates	>49	

I/3.1.2.2. Survey and Monitoring of Game Species

During the IRF team's discussions with the Forestry Department and members of the NICE and SIE, Forestry staff indicated that one of their major priorities is for the development of an assessment and monitoring programme for two of the Reserves' game species: the Armadillo and the Manicou. These two species are the most targeted of the island's terrestrial game animals. Though hunting is not permitted within the Reserves, illegal take of both species is prevalent. Forestry staff wanted to understand:

- Population numbers of both species;
- Population centres and distributions;
- Hunting impacts and pressures within and adjacent to the Reserves;
- Hunting practices and conditions; and
- Options for management and conservation of both species.

They requested that the IRF team provide an assessment of the species and design cost-effective survey and monitoring recommendations. Given the limited resources of this baseline study, this was not possible. The IRF team, however, made a commitment to provide recommendations after consulting with regional and international experts on such research. These recommendations are provided in Appendix 6 (Part II).

The IRF team was provided with a summary (June 2011) of the FAO Technical Cooperation Programme Facility Project.” This is a welcomed development but since it is in the preparation stages, the team has no way of evaluating its effectiveness.

A full discussion of the biodiversity of the GE&AFR is found in Part II of this report.

I/3.2. The Socio-Economic Context

I/3.2.1. Stakeholders and Enterprise Development Opportunities

In general, the OPAAL project appeared to have involved a wide and representative group of stakeholders from an early stage. This included discussions with local communities, environment-related NGOs, vendor associations, craft persons and tourism service providers.

Stakeholder participation was no doubt assisted by the fact that the Department of Forestry and National Parks has had a recent history of consultative planning involving many of these same stakeholders. There have also been a number of similar meetings held in conjunction with other projects and programmes.

The enterprise development component of OPAAL was apparently well received, and considerable expectations were generated regarding the positive outcome of this approach. Considering that OPAAL was developing on the heels of the tremendous disruption and economic hardship caused by the passage of Hurricane Ivan in 2004 and then Emily in 2005, the need for such programmes was obvious.

Unfortunately, IRF's discussions with several stakeholders suggest that the initial promise of the training and financial assistance to developing entrepreneurs had not been adequately fulfilled by the time of our visit, and considerable frustration was evident. Most of the stakeholders were not aware that long delays (until December 2009) in signing the subproject agreement delayed the start of training and capacity building in the livelihoods segment of the project. Obviously, most participants felt it was not satisfactory to be starting training and capacity building nearly at the end of the OPAAL project.

The possible livelihoods in the Forest Reserves/National Park identified for this element were favourably reviewed by most, although a minority of stakeholders said the listing felt somewhat restricted to isolated, small projects with little integration of the enterprise components at the community level. They had expected that such an approach would have involved a larger number of trainees and broader community impact.

The slow release of funds, and apparent confusion on the role of the SIE, the NICE, and their respective leadership, resulted in long periods between meetings of these groups which were intended to be key elements for coordinating OPAAL and related national livelihoods initiatives (some related to post-Ivan and -Emily recovery programmes). Later attempts to recover from the late start persuaded some participants interviewed by the IRF team that the OPAAL programme was too much a top-down bureaucratic exercise with less interest in working with local groups.

A full discussion of the socio-economic context of the Protected Area programme at the GE&AFR is found in Part III of this report, with related issues discussed in Part IV.

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1/5. List of Persons Consulted

Table 6. Persons Consulted during the IRF Baseline Surveys.

Name	Position/Designation	Organisation/Agency
Mr. Anthony Jeremiah	Senior Forestry Officer / OPAAL National Project Coordinator	Department of Forestry and National Parks (DFNP)
Dr. George Vincent	Consultant	Ministry of Tourism
Mr. Christopher Joseph	Environment Department	Ministry of Environment
Mr. Kevin Dottin	Site Coordinator, OPAAL	(DFNP)
Mr. Aden Forteau	Chief Forestry Officer	(DFNP) / Head of NICE
Mr. Lennox Taylor	Acting Head of Physical Planning Department / Head Planning Section	Department of Physical Planning
Mr. Raymond Baptiste	Chief Land Use Officer	Land Use Unit, Ministry of Agriculture
Mr. Allan Neptune	Quality Manager	NAWASA
Ms. Sandra Ferguson	Executive Director	Association for Rural Transformation (ART)
Ms. Denise Ogilvie	CEO	Partners In Action
Mr. Wilfred Jones	Manager	Grand Etang House (SIE Member)
Mr. Daniel Lewis	Chief Agricultural Officer	Ministry of Agriculture
Mr. Aaron Francois	Permanent Secretary	Ministry of Agriculture
Ms. Elizabeth Ross	Member	Vendor's Association
Mr. Allan Joseph	Member	NISP
Mr. Evan Gooding	President	NE Farmers Organisation
Mr. Phillip Mitchel	Members	
Mr. Reginald Peary		
Mr. Phillip Munro		
Mr. Simon Stiell	Director	Board of Tourism
Mr. Noel Niles	Member	Annandale Community
Mr. Tyrone Buckmire	Executive Director	Grenada Fund for Conservation
Inspector Smith-Roberts	Assistant Commissioner	Grenada Police Service
	Head	New Hampshire Community Group
Name not recorded	Craft Vendor	Cruise Terminal
Name not recorded	Restaurant Owner	St. George's

PART II

ENVIRONMENTAL BASELINE STUDY

II/1. Introduction to Environmental Study

Part II of IRF's environmental and socio-economic baseline studies for the Organisation of Eastern Caribbean States OPAAL Project in Grenada presents a biodiversity inventory and status assessment report for the Grand Etang and Annandale Forest Reserves.

The assessment and survey of the flora and fauna of the Reserves included three phases. The first was a review of historical literature, reports and notes, as well as discussions with key local individuals and experts. The second was a field survey of the area from 24th to 30th January 2011, and the third was the mapping (where possible). The objective was to determine the status of current flora, fauna and ecosystems as well as threats to and issues related to these natural assets.

Part II outlines the team's week of activities and findings, and summarises the ecological and environmental resources and management issues for the Reserves. It provides recommendations and suggested priority actions for addressing problems and improving the long-term sustainability and effectiveness of the Reserves.

The flora, fauna, ecosystems and landscapes of Grand Etang and Annandale Forest Reserves are very specialised, adapted to the high, cool, high-humidity and wet-mountain environments of the island of Grenada.

Many of the species are specialised, adapted to these conditions, though some are more elastic in their habits and able to tolerate a broad range of environmental situations. *Some species, habitats and ecological processes are exclusive to particular sites, habitats and situations of the montane areas, while others are found more widely across the island.* Many plants, such as the tree ferns and the Cabbage Palm, and birds such as the Grenada Euler's Flycatcher (*L. euleri johnstonei*), and bats such as the Yellow-shouldered Bat (*S. lilium serotinus*), and vegetation communities such as cloud forests, are primarily exclusive to the higher slopes of the island's peaks.

Nevertheless, while some species and ecosystems are restricted, others are widely distributed throughout the island. Species such as the Mexican Free-tailed and Jamaican Fruit Bats and the Lesser Antillean Bullfinch are found across many habitats and zones. Many species, such as birds are transient, some staying as long as food and shelter are available, others only passing through the area on their way to more productive grounds.

The species, habitats, ecological processes, services and issues of the Grand Etang and Annandale Forest Reserves are quite extensive and complex, and it was not possible to conduct a more comprehensive and detailed survey given the project's timeframe and resources. A more representative and comprehensive assessment of the biodiversity within the environments of the Reserves would have required going beyond the confines of the human-imposed boundaries and limits in order to assess those features and assets that affect or impact the Forest Reserves.

With this in mind, the team conducted targeted surveys of specific areas with the assistance of government staff when they were available, primarily for daytime fieldwork. Given the long hours and difficult nature of evening surveys, the team conducted these exclusive of outside assistance. The team carried out assessments and searches on foot by using trails, natural access points, aerial imagery, random surveys, natural species congregation and aggregation points, flyways and along roads.

The vegetation communities have been assessed using the classification of the International Institute of Tropical Forestry (IITF), 2001, Lindsay and Horwith, 1997, and Beard, 1949.

For fauna, similar techniques were used, species were identified and catalogued, and some qualitative assessment provided.

II/1.1. Approach to the Environmental Baseline Study

II/1.1.1. Literature Review

Extensive literature reviews were carried out to identify as comprehensive a documentation of source material relevant to the biodiversity of Grenada and, in particular, to the Grand Etang and Annandale Forests. This involved Internet searches as well as review of records held by various libraries known to have significant acquisitions of biodiversity material from the Caribbean, including IRFs own extensive collection of Caribbean material in Washington DC.

A listing of the literature reviewed is provided in the References Section of this report (see Part I, Section 6).

II/1.1.2. Collection of Mapped Data (digital and hard copy)

Map data for the whole of Grenada and specifically for the two reserves was sought from a number of sources, including the Land Use Department of the Ministry of Agriculture, which has a GIS Unit, published paper maps available at the Ministry of Agriculture, various reports and publications with map data including OPAAL reports, Satellite imagery from Google Earth and Bing, and printed versions of satellite imagery available at the GIS Unit.

Assistance was also sought from The Nature Conservancy (TNC), which has been active in Grenada for some time.

GIS data were provided in several projections, and metadata identifying the projection was rarely included with the map files. This led to delays in mounting and using data and the need for additional correspondence to sort out the details. Surprisingly, considering the current baseline study occurred almost at the end of the larger project, there were delays obtaining boundary maps of the two forest reserves—data that would normally be considered very basic to the management of any spatial natural resource, but was not available until the last week of the project.

II/1.2. Biodiversity Snapshot

The landscapes of the two Forest Reserves consist of steep narrow valleys, knife-edged ridges, rocky outcrops and cliffs, swamps, marshes, landslips and other geological scars, rivers and streams, lakes, reservoirs, small upland pools, forests, woodlands, agricultural fields, adjacent villages and towns, and grasslands.

According to World Wildlife Fund's (WWF) global ecoregion classification framework (2011), Grand Etang and Annandale Forest Reserves fall within the Windward Islands Moist Forest category. The WWF defines ecoregions as "*...large areas of relatively uniform climate that harbour a characteristic set of species and ecological communities. By focusing on large, biologically distinct areas of land and water, the Global Ecoregions set the stage for conserving biodiversity.*"

Grenada falls within one of the world's most important conservation areas, the Caribbean biodiversity hotspot, given its size, number of endemic species and unique ecosystems, and the severe threats to many of these species and systems.

The IRF team spent four days working on the ground conducting field surveys, and covered less than 5 percent of the area of the Reserves. Given the time and resource constraints, the team concentrated on known trails and sites because this approach provided the most cost-effective way to develop a broad area overview. There were no random surveys and transects, and no visits and assessments were done to isolated valleys or along the steep slopes of the Reserves.

While the rapid assessment of the areas visited was adequate for a broad understanding of the biodiversity issues, it ***does not provide a comprehensive or critical conservation and taxonomic assessment of the area's species, ecosystems and ecological processes.*** Careful, long-term work is required to provide planners and managers with the ecological and taxonomic data that are an important foundation for the conservation and management frameworks needed to conserve the natural resources of the area which have national, regional and global significance.

Though the biodiversity within the Reserves remains not fully documented and imperfectly understood, there are a number of lists of species. A summary of the species found on the ground and mentioned prominently in the scientific literature are presented in Table 7. More detailed information on the biodiversity of the Grand Etang and Annandale Forest Reserve is provided in the General Observations section below.

Table 7. Species Assessed in the Rapid Baseline Assessment.

Class	Numbers
Birds:	at least 75 species
Mammals:	at least 23 species
Amphibians and Reptiles:	about 16 species
Fish:	No lists available
Invertebrates:	49 species were recorded
Plants:	441 species, of which
— <i>Trees</i>	— 130 species
— <i>Shrubs</i>	— 62 species
— <i>Vines</i>	— 53 species
— <i>Herbs</i>	— 196 species
Plant families:	116 plant families, — 2 invasive species ² — 27 introduced species
Habitat:	18 Defined Vegetation Communities

II/1.3 Methodologies

Prior to and during the period of field surveys, the IRF team undertook extensive reviews of existing literature, aerial imagery and baseline information relevant to the island, the Forest Reserves and surrounding areas, and also consulted with local and regional experts.

The IRF field team ensured that on each daytime field visit it was accompanied by a representative of the Forestry Department. This allowed for interaction between local personnel and the consultations, provided safety and security and a much more effective two-way communication and transfer of information approach for all involved.

In carrying out the biodiversity assessment, the team was unable to undertake definitive population estimates, including detailed distribution data, population dynamics or any other systematic estimates, because the timeline, circumstances and resources of this exercise only allowed for a relatively cursory study. Where possible, the team made every effort to provide some information on species status, but this is based on local knowledge, historical accounts, reports, and on species' biology. The status estimates are given as "common," "rare," "uncommon," "widespread," etc. Where more detailed information is available, the consultants have attempted to apply this to situations within the Reserves.

² See "Invasive Plant Species," below.

For more concrete and accurate population estimates, systematic surveys and monitoring would need to be carried out by trained personnel over a multi-year time span. Systematic surveys are based on protocols, methodologies and statistical analyses that provide spatial, ecological, biological and structural data that equip resources managers with needed information. Baseline surveys therefore require longer-term research, as well as the strengthening of the scientific, research and monitoring capacities of key government and civil society institutions and individuals in Grenada.

II/1.3.1. Survey of the Landscape and Issues

Landscape values and resources tend to be more esoteric in nature and, hence, more difficult to define and characterise. Capturing the landscape values and qualities of Grand Etang and Annandale and making them more concrete in representation is no easy task, and the team had to try to link some of the more abstract of these resources with local understanding and expectations, for example, linking the spectacular vistas from certain viewpoints with the plant species and the overall health of the vegetation communities of the Reserves.

Prior to the fieldwork, the team decided on some broad themes for landscape issues. These included:

- Outstanding areas and features that are unique to the areas and help to define them;
- Peaks and summits;
- Bodies of water;
- Outstanding and unique wildlife;
- Vistas;
- Unique ecological, geological and other natural activities/features such as caves, fumaroles, spectacular blooms of certain species or the mass migration of animals or invertebrates;
- Once-in-a-lifetime opportunities for experiencing or accomplishing a feat such as climbing the highest peak; and
- Historical and heritage resources.

The team then combed through the available literature to determine what experts and others had reported on the Reserves' key features and how they had represented them. On meeting with stakeholders, the team asked individuals for assistance in identifying these features and assets where possible. During field surveys, these features and assets were noted when encountered.

II/1.3.2. Survey of Heritage and Cultural Resources

Similarly, information for heritage and cultural resources was obtained from desktop research, during field visits, discussions with local residents and experts, and from official documentary evidence and reports.

II/1.3.3. Survey of the Vegetation and Flora

Given the limited nature of vegetation community studies of Grenada, the IRF team had to pull together information and details from disparate sources and ideas to update the vegetation classification and description for Grand Etang, Annandale and surrounding areas.

For Grenada, the most comprehensive survey and characterisation of the vegetation was completed by J.S. Beard (1949) in his *Vegetation of the Windward and Leeward Islands*. Beard visited Grenada and other islands of the region and provided extensive descriptions of vegetation community structure, locations, formations, species, distributions and some population data. His focus was mainly on trees and shrubs, and, in fact, Beard's work was for the most part concerned with timber species management. This focus on the valuable commercial species meant that many of the smaller and less valued plants remained obscure, and his species lists are not complete.

No other expert has since approached Beard's effort in its comprehensiveness, complexity and in-depth analysis of causes and effect.

Beard's work also preceded the devastating impact of Hurricane Janet in 1955. Much of the vegetation structure, forms and species' assemblages would have changed dramatically, and in many instances, Beard's descriptions would have been literally blown away. To understand some of these ecological shifts, the IRF team again consulted with regional and international experts, and received a glimpse into changes to the forest system of Grand Etang as a result of hurricane destruction, from the research findings of the International Institute of Tropical Forestry (IITF). Dr. Peter Weaver from the Institute, in conjunction with the University of Puerto Rico and the Grenada Forestry Department, monitor two plots established on the forested slopes above Grand Etang Lake in 1994. This was 10 years before the passage of Tropical Storm Earl and Hurricane Ivan in 2004, and 11 years before Emily in 2005. The plots were monitored over a 13-year period, from 1994 to 1999 and 1999 to 2007.

On one 0.4 ha plot, the passage of Ivan reduced tree stem numbers by as much as 45% and the overall basal area by 20%. This dramatic decline in biomass must have caused considerable shifts in the system's ecological processes and dynamics, much of which are still on-going in a protracted recovery process. The IITF's team's work also allowed some comparison between J.S. Beard's 1940's vegetation community characterisations before

and after the passage of Hurricane Janet in 1955. Indications are that a similar ecological shift occurred (Weaver, 2008.)

A principal conclusion of the IITF studies is that Grenada's vegetation is less adapted to the disruptions brought about by these severe and dramatic storms than islands that lie along the regular paths of such annual events. These islands, lying north of Grenada and in the main path of hurricanes over the centuries, have experienced relatively frequent storms, some very severe. They therefore have adapted to this climate pattern, and recovery is much more rapid. Forest systems in Grenada on the other hand seem to repair and recuperate more slowly and unevenly.³

The flora were assessed by traversing some of the Reserves' main and secondary trails, as well as by hiking along rivers, streams and drains, by targeting outstanding areas and features such as grasslands, rocky outcrops, and areas thought to hold significant potential to yield interesting species. The survey team also targeted specific plant communities and focused on the unique features and characteristics and species makeup. Specimens were identified on site, and where and when necessary, photos and specimens were taken for further study and identification.

The team also used aerial imagery to determine past and current land-use, vegetation types and distribution, outstanding and special features, and the location of possible historical/archaeological sites. Where possible, the team took GPS readings of rare plants, special features, structures of special conservation concern, those that presented identification challenges, and those collected and pressed as specimens.

II/1.3.4. Survey of Terrestrial Vertebrates

The terrestrial macro vertebrate fauna of Grand Etang and Annandale Forest Reserves are limited to native bats, the introduced Mona Monkey (*Cercopithecus mona*), the Mouse Opossum (*Marmosa robinsoni*), the supposedly introduced Common Opossum (*Didelphis marsupial insularis*), the Nine-banded Armadillo, the introduced Black and Norway Rats (*Rattus rattus* and *R. norvegicus*), the House Mouse (*Mus musculus*), the introduced Indian Mongoose (*Herpestes javanicus*), birds and reptiles.

Reptiles were surveyed and assessed using a combination of incidental observations and encounters, targeted searches of habitats and specific sites/features, from previous reports and records, and from expert knowledge and familiarity with the area. Amphibians were similarly assessed.

³ This may imply longer term risks for Grenada in the face of the climate change predictions from the Intergovernmental Panel for Climate Change (IPCC IV, 2010). These predictions call for more climate variability that may lead to a wider range of hurricane paths and more frequent approaches to Grenada.

Bats were surveyed by: a) five nights of observations and three of mist-netting; 2) incidental observations of bat activities; 3) literature reviews; and 4) discussions with key experts. The three nights of netting produced 100 captures, representing seven species.

For birds, the survey team undertook roost surveys and targeted specific sites such as feeding and nesting areas; incidental observations and previous reports and records and feedback from local stakeholders were also used.

II/1.3.5. Survey of Terrestrial and Aquatic Invertebrates

No formal surveys of terrestrial and aquatic invertebrates were carried out. This was because of the timeframe for the project, the intense demands of invertebrate surveys and species identification, and the limited financial resources available for the project. However, invertebrates were noted where and whenever possible, and our report provides a brief summary for a number of groups and species.

II/1.3.6. Survey of Threatened, Rare and Endangered Species and Habitats

Special and particular care was taken to locate and identify any critical species of plants, animals and habitats and determine the particular threats and issues relating to their conservation status.

II/2. Observations: Vegetation and Flora

II/2.1. Vegetation Communities

The IRF team has attempted to reconcile the vegetation communities of Grenada with the three major classification systems of the Lesser Antilles (Table 8). From this exercise, 18 vegetation communities are listed for the Reserves.

Table 8. Vegetation Communities and Classification Matrix for Grenada.

NO.	BEARD (1949)	IRF CLASSIFICATION (1999)	IITF CLASSIFICATION (1999-2008)	Present in Grenada
1	Secondary Forest	Montane Tropical or Sub-tropical Rainforest	Seasonal Forest	
2	Secondary Forest		Evergreen Forest/Sierra Palm Forest	*
3	Rain Forest			*
4	Montane Thicket			*
5	Palm Brake	Montane Tropical or Sub-tropical Rainforest	Sierra Palm	*
6		Tropical or Sub-tropical Evergreen Woodland		*
7	Elfin Woodland	Tropical or Sub-tropical Cloud Forest	Elfin Woodland	*
8	None	Tropical or Sub-tropical Broad-leaved Evergreen Woodland	None	*
9	None	Medium-tall Tropical or Subtropical Grassland with Sparse Broad-leaved Evergreen Tree Layer	None	*
10	None	Tall Tropical or Sub-tropical Perennial Forb Vegetation	Steep Non-forest Vegetation	*
11	Pioneer Communities of Volcanic Ejecta	Tropical or Sub-tropical Broad-leaved Evergreen Shrubland.	Montane Non-Forest Vegetation	
12	None	Permanently Flooded Tropical or Subtropical Hydromorphic Rooted Vegetation	Freshwater Wetland	*
13	None		Aquatic/Water – Permanent	*
14	None		Pasture	*
15	None	Planted/Cultivated	Cultivation – Herbaceous/Cultivated Lands	*
16	None	None	Cultivation – Tree Crop/Mixed and Woody Agric. Coconut Palm with Pasture	*
17	None	None	Rural/Built	*
18	None	None	Bare Soil	*

The **vegetation of Grand Etang** consists of 14 types, including:

- Seasonal Forest
- Evergreen Forest/Sierra Palm Forest
- Sierra Palm
- Elfin Woodland
- Broad-leaved Evergreen Woodland
- Grassland with Sparse Broad-leaved Evergreen Tree Layer
- Steep Non-forest Vegetation
- Freshwater Wetland
- Aquatic/Water - Permanent
- Pasture
- Cultivation – Herbaceous/Cultivated Lands
- Cultivation – Tree Crop/Mixed and Woody Agric. Coconut Palm with Pasture
- Rural/Built
- Bare Soil: This may include landslips and slides, exposed banks along streams, rivers and ghauts, and communities with vegetation cover of 10% or less.

The **vegetation of Annandale** consists of 11 types, including:

- Seasonal Forest
- Evergreen Forest/Sierra Palm Forest
- Broad-leaved Evergreen Woodland
- Grassland with Sparse Broad-leaved Evergreen Tree Layer
- Steep Non-forest Vegetation
- Aquatic/Water - Permanent
- Pasture
- Cultivation – Herbaceous/Cultivated Lands
- Cultivation – Tree Crop/Mixed and Woody Agric. Coconut Palm with Pasture
- Rural/Built
- Bare Soil: This may include landslips and slides, exposed banks along streams, rivers and ghauts, and communities with vegetation cover of 10% or less.

II/2.2. Flora

The plant lists for the Grand Etang and Annandale Forest Reserves have been compiled from various sources, including direct field observations and assessments from the IRF team's January 2011 site visits and from the work of previous collectors and experts, including Beard (1949), Groom (1970), and Howard (1977 to 1985). The “real” total number of plant species can only be determined by the kind of systematic scientific surveys that have not yet been done, but which are recommended because of the high rate of endemism in Grenada. The plant list in Appendix 2 of Part II of this report provides an overview of plants of the reserve areas, including new records observed.

This compilation required considerable effort and time by the IRF scientists, not only because it involve identifying difficult species—even new island records and possibly new taxa—but also because, since the publication of Howard's monumental *Flora of the Lesser Antilles*, considerable taxonomic reviews have taken place, resulting in many name and family changes. There is also no comprehensive national plant list for the country, and this is problematic because such a list would have provided the basis for comparative analysis and assessment of potentially new records, new species, a proper review of taxonomic shifts, and possible conservation challenges.

Understanding the Reserves' flora also requires going beyond its boundaries, something that was largely impossible under this effort given the time and resource constraints. Only by viewing the plant species of the Reserves in relation to the overall biodiversity dynamics of the island system can there truly be an effective assessment and analysis of the Reserves' flora.

Additionally, the flora of the Reserves are connected to those of nearby peaks and to the islands further along the chain, including the Grenadines and St. Vincent, even to the wider region. Grenada forms a fundamental ecological “bridge” between the islands to the south, including Trinidad and Tobago and the Netherlands Antilles, and the continent of South America. The movements of genetic material from the north and from the south have formed the basis for many of the island endemics found in Grenada. The recent discovery of *Visma* (see Photo 6 below) on Grenada, a genus hitherto unknown from the region, illustrates that Grenada draws species from the **bio-rich** south, funnelling material to small volcanic peaks and limestone caps throughout the Lesser Antilles.

The lists of plants provided in Appendix 2 of this report are wholly inadequate to explain, characterise and understand the flora of Grand Etang, Annandale and nearby areas. The Reserves' flora is a complex of seasonal forest, grasslands, secondary forest, agricultural, edge habitats, lower and upper montane forests and woodlands, elfin shrubland, elfin savannahs, bogs and other systems. A far more comprehensive, careful and long-term review is needed in order to tease out the area's most finite details about its plants and their ecology, their conservation status, uses and histories.

As indicated throughout Part II of this report, the baseline survey of the flora of the Reserves is only a preliminary effort. Nevertheless, this preliminary effort resulted in the following findings:

Approximately **441 plant species** were reported in 116 families, of which—

- 130 are trees (or about ~29%),
- 62 are shrubs (or about ~14%),
- 53 are vines (or about ~12%),
- 196 are herbs (or about ~44%).

There are four invasive species, and 27 introduced. Pteridophytes (ferns and fern allies) make up the largest single group of plants in the herbs, representing: 66 (or 34% of the 196 herbaceous plant species).

There were a number of new records for the island that resulted as an outcome of this effort. These include:

Cissus obovata: This species, though widespread in the Lesser and Greater Antilles, has not been previously reported for Grenada. This member of the family Vitaceae, the grape family, is a West Indian endemic.

Didymoglossum cf. pusillum: This is a small filmy fern. If the identification is confirmed, this would represent a new record for the island.

Dioscorea cf. altissima: This is a widespread species throughout much of the more mountainous islands of the Lesser Antilles. The identification herein is listed as tentative, but, if confirmed, it would be a new record for the island. The species is common throughout the forests of Grand Etang. See Photo 1.

Epidendrum fragrans: Though this orchid is widespread through much of the Lesser Antilles and South America, it was not previously reported for Grenada. It is common in the forest of Annandale and can be found on the branches of citrus and other tree species. See Photo 2.



Photo 1. The thorny stem of *D. altissima*.



Photo 2. *Epidendrum fragrans* at Annandale Forest Reserve.

***Miconia cf. furfurcea*:** This identification of the species is quite tenuous, and is herein listed as tentative. The species name given here is not convincing since the specimens observed are pilose and, along with other characteristics, may represent an unknown *Tetrazygia*.

***Pinzona coriacea*:** This high climbing member of the family Dilleniaceae is known from Guadeloupe, Dominica, Saint Lucia, the Greater Antilles and South America. It was not previously reported for Grenada, which is surprising since the stems of this large climber are often cut and the sap drunk to quench the thirst. See Photo 3.

***Siparuna sp.*:** This is a new record for the island. The identification listed here is tentative. The closest possible species is *Siparuna glabrescens*, a plant endemic to the Windward Islands from Dominica to St. Vincent. However, the morphology of this species does not fit with that of those islands, and further work needs to be done to confirm its taxonomy. See Photo 4.

***Triphora surinamensis*:** This small inconspicuous terrestrial member of the orchid family was not previously reported. It was found growing at the base of a bamboo clump at Annandale. Only one was observed. See Photo. 5



Photo 3. *Pinzona coriacea* near Grand Etang.



Photo 4. *Siparuna* sp. found at Margaret's Road and around Grand Etang.



Photo 5. The terrestrial orchid *Triphora surinamensis* amongst the bamboo roots at Annandale.

The examples listed above demonstrate that even a brief visit to fairly well known areas in the Reserves, such as those visited by the IRF team, can yield new records and even new species, and also indicates that the island's flora is not yet well studied and is inadequately understood. More important discoveries remain to be found, and this is critical if authorities are going to manage the island's biodiversity effectively—if you don't know what you have, how can you manage it?

II/2.3. Plant Species of Special Conservation Concern

In addition to the new plant records listed above, which are of concern because virtually nothing is known about their conservation status in Grenada, there are two other species that are of conservation concern:

***Maytenus grenadensis*:** This species is one of a handful of plants endemic to Grenada. It is relatively widespread in Grand Etang and other montane areas.

***Vismia* sp:** This species was first recorded by Hawthorne, *et al* in 2003. Its taxonomy remains unresolved and its relationships to other members of its genus unclear. It is found at Grand Etang and scattered locations in montane areas of the island. Its overall conservation status is relatively unknown. See Photo 6 below.



Photo 6. *Visma* sp. at Grand Etang.

II/2.4. Invasive Plant Species

There are four invasive plant species that have become established in both Reserves. These are: Bamboo (*Bambusa vulgaris*), Kudzu (*Pueraria phaseoloides*) and Wild Hops (*Fleminga strobilifera*), introductions from Asia, and the Blue Mountain Mahoe (*Talipariti elatus*), originally from Jamaica.

The **Bamboo** has been introduced throughout the Caribbean and Tropical America, valued for its wood, used for shade and landscaping. In the past, bamboo was thought to be effective for soil conservation, but it may actually exacerbate soil slippage on steep slopes. The species is prevalent throughout the steep slopes in Grenada and may represent one of the most invasive species, crowding and shading out native species and changing soil chemistry, structure and hydrology. It is water-demanding and hence competes with other plants, restricting their access to moisture. It also dramatically changes the ecology of an area through its ability to dominate the space around it and by changing natural functions. Its fallen leaves produce chemical compounds that allow it to restrict the growth of potential competitors below its branches.

Despite the fact that the species has one of the most dynamic commercial woods in the world, it is not commercially harvested on the island. It is, however, prevalent and dangerously invasive in Grenada and efforts should be made to reduce its impacts and restore native systems.

The **Mahoe** is of major concern. It is an introduced timber and watershed restoration species, and is a critical component of the Forestry Department's reforestation efforts. However, the species seeds exceedingly well on Grenada, and has established natural stands throughout the montane areas of the island. This means that efforts to re-tree areas damaged by hurricanes with this species have been more than effective, even too effective. Mahoe spreads quite easily, and, in some areas, tree stands may consist almost entirely of this species. It is non-native and excludes native species from the space it occupies. This changes natural ecological dynamics, and native forest habitats do not exist in much of the area as a result of this species and Bamboo.

Adding to the conflicting benefits and impacts that this species may be having on the ecology of the Reserves is the fact that many birds and bats may have benefitted from the presence of the Mahoe. It produces copious amounts of nectar and pollen, which are excellent food sources for birds, bats and opossums. However, the species also has adverse impacts, and it is critical that these factors be studied and weighed to determine if long-term management and control of the species needs to be undertaken.

Kudzu, though seriously invasive in many tropical and sub-tropical areas of the world, has not reached problem proportions in the Reserves. It should be monitored, however, in case it becomes more invasive. Early detection of changes in behaviour would improve chances for effective control.

The **Wild Hops** is most common in lower elevations but is also found in upland fields, pastures, edges of farms, and forest edges. Though it spreads easily and can sometimes form monotypic stands, its impact seems relatively benign, and it is easily overcome by advancing forest and woodland and soon succumbs. No control of this species seems necessary at this time.

II/3. Observations: Fauna

II/3.1. General Observations

Despite Grenada's relatively long history of protected area management and established reserves, the native and naturalised animals of Grand Etang and Annandale have remained relatively obscure and understudied. In the 1960s, a time of dramatic social, economic and technological changes and evolution across the globe, Dr. J.R. Groome, past-President of the Grenada National Trust, teacher and researcher, sought to shed some light on and increase awareness for the island's natural heritage. In 1970, he published *A Natural History of the Island of Grenada, W.I.* This small book of 115 pages covers a wide range of subjects, including the island's rich and complex geology, its diverse landscapes, agriculture, native and naturalised species, pests and its more notable invertebrates. Groome's work, though written more than 40 years ago—nearly a half a century—remains the most comprehensive tome on Grenada's flora and fauna to date.

Documenting the country's rich natural heritage remains problematic, as is also the case for most of the islands of the Eastern Caribbean. The state of knowledge and understanding of the ecological and environmental underpinnings of Grand Etang and Annandale are not sufficient for the needs of the national patrimony. The IRF team's week of surveys in these two reserves offers only a fleeting glimpse into the vast and complex natural history of these two sites—from documenting rare bats such as the Yellow-shouldered bat (*Sturnira lilium*), to new orchid records for the islands such as *Triphora surinamensis* and *Epidendrum fragrans*.

Given the overall lack of local capacity and resources to systematically document, study, understand and manage the ecological resources of the Reserves, the challenge is how to develop the means to address this obvious gap. This challenge is something that was at the forefront as the team proceeded through its fieldwork and interacted with local stakeholders and government staff.

The species, populations and natural systems of the two Reserves, especially its birds and invertebrates, fluctuate depending on the season, the amount of rain, the availability of food, and available nesting habitat.

North American migrant birds arrive in full force in late October and early November, some only stopping to gorge themselves on the fresh flush of insects, foliage, flowers, nectar, pollen and fruit, which are available in abundance as a result of the rains of this time of the year. Many of the birds continue southward to Trinidad and South America—the forests, fields and woodlands of Grand Etang and Annandale are stepping stones on the way.

The forests, woodlands, swift streams and rivers, plantations and agricultural fields are home to some of the country's rarest birds, many being West Indian regional endemic species or the only populations in the Caribbean. These include the Scaly-naped Pigeon (*P.*

squamosa), Grenada Euler's Flycatcher (*L. euleri johnstonei*), the Lesser Antillean Tanager (*T. cucullata*) and the Pearly-eyed Thrasher (*M. fuscus*).

Grenada Euler's Flycatcher was last reliably reported in the 1950s around Grand Etang, but sadly may now be extinct.

For reptiles, the species include the small endemic snake *Typhlops tasymicris*, usually found burrowing in loose soil and leaf litter. Other snake species include several that are more widespread continental forms found throughout parts of South America. The Anole species of the Reserves are also widely distributed.

There are three species of frogs and one toad found in both reserves. These include the Grenada Bank endemic, the Grenada Ditch Frog (*P. euphronides*), the introduced Lesser Antillean Frog (*E. johnstonei*), and the range-restricted Windward Islands Ditch Frog (*L. validus*), endemic to St. Vincent, the Grenadines, Grenada, Trinidad and Tobago. The one toad is the introduced Marine Toad (*R. marinus*).

For mammals, at least 14 species of bats are known to occur in Grenada, most found in and around the forests, woodlands and fields of Grand Etang and Annandale. A list of these species and their status is provided in Appendix 4, Part II of this report.

One other mammal, Robinson's Mouse Opossum (*M. robinsoni*), is believed to be native, though some experts have expressed doubts about this. There are several other species of mammals that inhabit the Reserves. A complete list of the species is provided in Appendix 4, Part II of this report.

No systematic observations and assessments were carried out on terrestrial and aquatic invertebrates of Grand Etang and Annandale. Nevertheless, the team noted species where and when possible, and a summary list of the species known to occur in and around the reserves has been provided. The list includes several species of invertebrates that are known or believed to be restricted to Grenada, and of these, the 12 identified in Table 9 are either known or suspected within the two sites:

Most of these species are small and not easily observed. Virtually nothing is known about their overall status. Too little is currently known about the invertebrates of Grenada, and more studies are needed to determine the conservation needs of these species and to identify other native species of *special conservation concern*.

A summary list of the invertebrates of the Grand Etang and Annandale Forest Reserves is provided in Part II, Appendix 3 of this report.

Table 9. Endemic Invertebrate Species of Grand Etang or Annandale Forest Reserves.

Damselfly <i>Argia telesfordi</i>	Chalcidoid wasp <i>Miotropis histrionica</i>
Dragonfly <i>Brechmorhoga (praecox) grenadensis</i>	Centipede <i>Gonethina grenadensis</i>
Caddisfly <i>Farrodes grenada</i>	Land snail <i>Bulimulus wiebesi</i>
Tumblebug <i>Canthon perseverans</i>	Land snail <i>Aperostoma grenadense</i>
Ground beetle <i>Pseudaptinus thaxteri</i>	Land snail <i>Helicina keatei</i>
Ox beetle <i>Strategus tarquinius</i>	Land snail <i>Plekocheilus glaber grenadensis</i>

II/3.2. Birds

At least 75 species of birds are known to occur in and around the Reserves. The list of species has been compiled from observations during the recent field and from previous surveys and reports (see Appendix 1, Part II of this report).

It is important to note that the number of species seen during field operations reflects a short timeframe in the day and within the season, and offers only a sample of the numbers of species that may occur there throughout the year. The list will undoubtedly expand considerably if surveys were done more frequently covering all seasons, and as part of a systematic study that monitors the area's bird population.

Six species of birds of **special conservation concern** have been identified for the Reserves. These species are primarily regional endemics and local endemic subspecies and include:

1. The **Grenada Hook-billed Kite (*Chondrohierax uncinatus mirus*)**: Though found primarily in drier habitats, the species ventures up into mountain areas where it feeds on its preferred food, land snails. Every effort must be made to ensure that these snails are protected and populations are encouraged to expand. This would ensure the survival of this endemic subspecies.
2. The **Scaly-naped Pigeon (*Patagioenas squamosa*)**: Locally common in some areas, the species is still hunted in Grenada.
3. The **Purple-throated Carib (*Eulampis jugularis*)**: This is reportedly rare and accidental on Grenada, and its status on the island needs to be confirmed. Endemic to the Lesser Antilles.
4. The **Brown Trembler (*Cinclocerthia ruficauda*)**: Like the Purple-throated Carib, this species is also reported as rare and accidental on Grenada. It is a species of montane forest, woodland and gardens. Its status on Grenada needs further determination. Endemic to the Lesser Antilles.

5. The **Grenada Euler's Flycatcher (*Lathrotriccuseuleri johnstonei*)**: This species has been reported as extinct since it was last reported in the Grand Etang area in the 1950. It is presumed to have gone extinct after the passage of Hurricane Janet in 1955.
6. The **Grenadian/Saint Lucian Barn Owl (*Tyto alba insularis*)**: This unique subspecies, endemic to Dominica, Saint Lucia, St. Vincent and to Grenada, is declining throughout its range. On Grenada, the species is rare and also declining and this is of major concern. It is found in low to upper elevations, including Grand Etang and Annandale. It roosts and nests in caves, hollow trees and overhangs. Efforts must be made to protect this very important species.

II/3.3. Mammals

There are at least 24 species of mammals reported for Grenada, the majority of which are bats with about 14 species so far listed. In Grand Etang and Annandale, the mammals include 14 bats, two marsupials, one armadillo, the Small Indian Mongoose, rats, a monkey, and the occasional feral domestic cat. A complete list of the species can be found in Appendix 4/Part II. Of the 24 mammals, the **species of greatest conservation concern** include:

1. **Black Myotis (*Myotis nigricans*)**: This species of South America is very rare in Grenada, and forages in forest, woodlands, agricultural fields and gardens, along rivers and the edges of forest. Myotis is an insectivorous bat.
2. **Lesser Doglike Bat (*Peropteryx macrotisphaea*)**: The Lesser Doglike Bat subspecies *phaea* is endemic to Grenada. However, taxonomic questions remain, and making this more of a challenge is the fact that none have been captured on the island since 1910. It is a species of lower montane and deciduous-evergreen forest, but roosts in caves and has been observed at a small cave roost at Point Salines, rocks at Mount Pleasant and hollow rocks at Westerhall. The species, if it still survives on Grenada, likely moves up and down the steep valleys on its way to and from feeding grounds and roosts. It likely survives in small roosts in rock cavities and overhangs along steep embankments. The location of the cave at Point Salines is unknown and access to the area is restricted given that it is now a part of the airport facilities located there.
3. **Naked-backed Bat (*Pteronotus davyi davyi*)**: A single specimen of this species was taken in Grenada; location unknown. It was taken in the early 1970s. The subspecies *davyi* is restricted to the Lesser Antilles. These small insectivorous bats likely forage high in montane areas including Grand Etang and Annandale.
4. **Little Big-eared Bat (*Micronycteris megalotis*)**: This primarily South American insectivorous bat is represented in the Grenadian fauna by a lone specimen caught during the early part of the last century. Though some have doubted whether this represented an existing population on the island, it has subsequently been found to

exist on St. Vincent, making its presence on Grenada more than likely. It is a species that roosts in coastal caves but forages in lower to mid montane forests.

5. **Seba's Short-tailed Bat (*Carollia perspicillata perspicillata*):** The lone specimen of this species was acquired in 1867 without locality. It has not been collected on the island since then. It may now be extinct, though the gardens, fields, plantations, secondary forests and hurricane-damaged woodlands of the Reserves represent the habitat preferences of this species. It is found from Trinidad into South America.
6. **Bogota Fruit-eating Bat (*Artibeus bogatensis*):** This small *Artibeus* is known from a handful of specimens from Grenada. It is quite rare and localized, and prefers forests and woodlands. It has been netted at Grand Etang (Photo 7).



Photo 7. Female *A. bogatensis* specimen caught at Grand Etang.

7. **Flat-faced Fruit-eating Bat (*Artibeus planirostris*):** This species was previously unrecorded for Grenada and no specimens have yet been taken. Identification of species was done by using photo provided to Dr. Hugh Genoways, mammologist based at University of Nebraska-Lincoln. The specimen was netted at Grand Etang (Photo 8). Virtually nothing is known about its status on the island. It however seems local and rare. It is distributed from Grenada into northern South America.



Photo 8. *Artibeus planirostris* at Grand Etang.

8. **Yellow-shouldered Bat (*Sturnira lilium serotinus*):** This subspecies is endemic to Grenada. It is rare and seems to prefer montane forests and woodlands. It was netted at Grand Etang (Photo 9).



Photo 9. *Sturnira lilium serotinus* at Grand Etang.

9. **Robinson's Mouse Opossum (*Marmosa robinsoni*):** This opossum has been listed as native to Grenada, though some experts question this conclusion and suggest that this as well as the larger *Didelphis* are introduced. Careful study is needed to determine its origin, especially since the opossums as well as the armadillo have been identified by the Forestry Department as species of high priority.

For bats, the survey team carried out visual, roost, and mist netting surveys during the field work period. No roosts were located during the survey. At the end of the capture period, after nets were dismantled, the team took wing measurements, the gender of each individual, breeding status, and general health conditions of the specimens.

Further work is needed to assess the population of the species of bats: including how they are using the forest, their diets and the effects on the plant communities, the populations, roosting, and the importance of a healthy forest to the sustainability of the bats.

The introduced species of mammals include the Black Rat (*Rattus rattus*), the Norway or Brown Rat (*R. norvegicus*), the House Mouse (*Mus musculus*), the Indian Mongoose (*Herpestes javanicus*), the Mona Monkey (*Cercopithecus wolfi*), the domestic cat (*Felis catus*), the Manicou (*Didelphis marsupialis*) and the armadillo (*Dasypus novemcinctus*).

These introduced species move throughout the Reserves, and undoubtedly have a major effect on the ecology of the forest. The Mongoose, rats, Manicou and cat are known to predate on birds, amphibians, reptiles and invertebrates and will scavenge human waste and surroundings if available.

II/3.4. Reptiles and Amphibians

There are at least 21 species of terrestrial reptiles and amphibians recorded for Grenada, and of these, 15 are found in or around the Grand Etang and Annandale Forest Reserves. One species of frog, Mountain Chicken or Giant Ditch Frog (*Leptodactylus fallax*), and a snake—Neuwied's False Boa (*Pseudoboa newwiedi*)—are reportedly extinct. The Boa persists on Trinidad, Tobago and South America.

Attempts to reintroduce the Mountain Chicken in the 1950s and 1960s were reported to have failed. It is for this reason that it seems that the species is reported as introduced for the island.

One frog, a gecko and a snake are also listed as introduced.

There are four reptiles of *special conservation concern*. These include:

1. The **Mussurana (*Clelia clelia*):** This species has been listed as being possibly extirpated from Grenada for most of the twentieth and twenty-first centuries. It is a species widespread in northern South America, but was an important part of the

Grenadian fauna. It eats other snakes, and it is possible that the decline of other species due to the predation of the Mongoose reduced the prey of this *Clelia*. The Mongoose is likely to have also helped to drive the species to extinct. It is possible that the species hangs on in Grenada, but there have been no recent efforts to determine the status of this species on the island.

2. **Shaw's Black-backed Snake/Shaw's Dark (*Liophis melanotus*):** Similar to the species above, *Liophis* is widespread in South America, but is possibly extirpated from Grenada, due to predation of the Mongoose. More work is needed to determine the status of this species.
3. **The Ground Snake (*Pseudoboa newwiedi*):** The *Pseudoboa* is similar in habits to *Clelia*, and may have also declined when its preferred snake prey disappeared. The Mongoose has had a devastating impact on reptile populations, and as prey species numbers declined, so would their predators.
4. **The Grenada Green Iguana (*Iguana iguana*):** The Iguana is primarily found in drier habitats, but sometimes may venture up into more mesic forests of Grand Etang. It has become quite rare and populations continue to decline. Its populations on Grenada are in urgent need of assessment.

The Grenada Bank and regional endemic amphibians (*P. euphronides*) and the Windward Islands Ditch Frog (*L. validus*) are common and stable.

The Giant Ditch Frog (*L. fallax*) has gone extinct on most islands of the Lesser Antilles due to predation by the Mongoose, as it did on Grenada, but it is still found on Dominica and Montserrat. It is highly endangered. It is a species that favours mesic forest habitats, especially wide moist valleys, which Grenada possesses. Given the potential habitat, *if* the Mongoose could be eradicated from these areas and controlled, there is great potential for the reintroduction of the Giant Ditch Frog to the island.

A summary list of the amphibians and reptiles of the Forest Reserves is provided in Part II of this report, Appendix 5.

II/3.5. Game Species and Hunting

The wildlife game species of Grand Etang and Annandale include:

- The Mona Monkey
- The Nine-banded Armadillo or Tatou
- The Opossum or Manicou
- The Scaly-naped Pigeon or Ramier
- Iguana.

The season for hunting of these species opens on September 1st and closes on March 1st of each year. Hunting is regulated by the Department of Forestry. Hunting is not permitted within the Reserves. Forest Rangers actively engage users and visitors within these areas, and the possession of dogs and hunting accessories and tools are not allowed in Grand Etang and Annandale. Nevertheless, illegal hunting is widespread, and there is no data as to the scale of this problem. Much of this illegal activity takes place at night, and the focus of attention is on the Armadillo and the Opossum.

It is for this reason that the Forestry staff is particularly concerned about the latter species, and expressed to the IRF team a need for up-to-date population data and for long-term monitoring. In light of this, the team has outlined concerns and issues regarding the assessment and monitoring of game species in the Reserves.

II/3.5.1. Survey and Monitoring of Game Species

During the IRF team's first day's discussion with the Forestry Department and members of the NICE and SIE, Forestry staff indicated that one of their major priorities is for the development of an assessment and monitoring programme for two of the Reserves' game species: the Armadillo and the Manicou. These two species are the most targeted of the island's terrestrial game animals. Though hunting is not permitted within the Reserves, illegal take of both species is prevalent. Forestry personnel wanted to understand:

- Population numbers of both species;
- Population centres and distributions;
- Hunting impacts and pressures within and adjacent to the Reserves;
- Hunting practices and conditions; and
- Options for management and conservation of both species.

They requested that, if possible, the IRF team while in Grenada, provide an assessment of the species, and design effective and cost-effective survey and monitoring recommendations.

Given the timeframe, the Terms of Reference in IRF's contract with OECS, and the financial resources of this consultancy, this would have been too extensive an undertaking to be feasible during the visit. The team however expressed a commitment to assist where possible and to provide recommendations after reviewing the issues and consulting with regional and international experts on such research.

The team has provided an outline of its review of the situation and a set of recommendations to address the issues in Appendix 6, Part II of this report.

II/3.6. Invasive Vertebrate Species

In addition to the introduced Black and Brown Rats (*Rattus* sp.) and the House Mouse (*Mus musculus*), the two most significant introduced species are the small Indian Mongoose (*Herpestes javanicus*) and the Mona Monkey (*Cercopithecus mona*).

The **rats** and mice were introduced throughout the Caribbean from Europe sometime in the fifteenth century, transported aboard sailing ships. Ecologically, the species are quite adaptable, thriving in a wide variety of the island's habitats, and able to exploit many types of food sources, including vegetable and animal matter. However, rats and mice are extremely difficult to control given their ecological habits, population numbers, size and difficulty in locating.

The **Indian Mongoose** was introduced to Grenada sometime in the 1800s in order to control snakes, with disastrous effects on the native animals. It is an aggressive and voracious predator, eating just about any vertebrate or invertebrate. Ground nesting birds and reptiles are especially vulnerable to this species. The decline of a number of species of snakes and reptiles, including *Clelia clelia* and *Ameiva ameiva* are attributed to the introduction and spread of this animal.

Everard, *et al* (1974) documented the occurrence of the rabies virus and disease in about 4 percent of the island's Mongoose population. Subsequent follow-up work confirmed these findings. Grenada, Cuba, Puerto Rico and the Dominican Republic are the only islands in the Caribbean known to harbour the virus in wild populations. The Mongoose is suspected to be the only natural host of the virus on the island. Efforts over the years to control animals (through trapping) have proved ineffective at reducing populations and the risks of transmission of the virus to domestic animals, livestock and humans remain. Vaccination programmes aimed at livestock and dogs have been attempted, though there is no consistent ongoing program of mongoose control or eradication.

The **Mona Monkey** was introduced to the island sometime in the 1700s or perhaps earlier from its natural rain forest habitats in West Africa or possibly via São Tomé where it was also introduced. The animals are now naturalised, an integral part of the local psyche, and residents incorporate the animal into the natural, social and economic fabric of the island—many thinking that it has always been a part of the Grenadian natural heritage.

The species is known to eat both plant and animal matter, including birds eggs, though studies suggest that a large part of its diet is plant based, and its predation of animals is largely incidental. However, this may be somewhat misleading and does not adequately and accurately paint a true picture of the impact of this species. The animal will eat many invertebrates, which along with bacteria, fungi and other micro-fauna and flora make up the bulk of the island's biodiversity. These animals are difficult to see and study, and they are easily overlooked and their significance is often dismissed.

Several recent studies, however, have shed some light on the ecology, culture and populations of the monkey on Grenada, including those at Grand Etang. Recent studies include Glenn (1996, 1997 & 2002), Glenn and Bensen (1998), Horsburg, *et al* (2004). These studies look at the species' populations throughout the island, ecology, diet, disease, biology and many other factors. The population density of the Mona Monkey at Grand Etang was calculated at 42.1 individuals/km². It is confined primarily to the montane and upper montane forests of the central ranges, especially around the forests of Grand Etang and Mount St. Catherine.

Grenadians traditionally hunted the Mona Monkey for food, thereby keeping numbers relatively low. As the cultural, economic and dietary pressures and preferences shifted, hunting of monkeys for food and as a means of pest control, especially around agricultural plots, declined through the 1990s. Hunting now has little or no impact on the monkey population on the island, though some targeted control is periodically done when individuals pose a health or safety risk.

Another invasive species of concern is the **feral domestic cat**. Though the species is not believed to be common or plentiful, feral cats are present since they were observed in the wilds of Grand Etang and Annandale on two occasions. Questions about cats posed to Forestry staff indicated that few believe that they are present, and therefore not a problem. Virtually nothing is known about the species in the wild. Studies and assessment are required to determine the population levels, impacts and need for control.

II/4. Conservation Issues and Targets

II/4.1. Restoring and Maintaining Ecological Integrity

Grand Etang and Annandale Forest Reserves are fragments of the larger Grenada landscape. The boundaries of these two areas are hard to see if one moves about the trees, rocks and slopes or watch birds dart about or insects hover on crisp clear wings. Nature works overtime to go about its business as if such imaginary borders are of no consequence whatsoever. Animals and plants respect no time and place for artificial human constructs. They perhaps have the greatest stake in the long-term protection of these areas, and yet, they show no apparent interest in whether it succeeds or fails.

For the two Reserves to have long-lasting impact and success, these seemingly thoughtless machinations of nature must not deter us from truly understanding what natural edifices underpin them. Labouring to learn, comprehend and know the complex ecological facets is critical to provide the best management practices that benefit Grenadians in the most tangible and effective ways.

But the reality of Grand Etang and Annandale cannot continue to be maintained as mere circumscribed fragments, cut off from the rest of a vibrant and interconnected whole. The Reserves and the surrounding landscapes, peoples and communities are as connected to the coasts and the sea as the heart is to the lungs. The rhythms of life beat up and down the corridors of the rivers, streams and ghauts that connect the forests, rushing waters—cascading down over rocks and into deep pools, and the steep wooded slopes, all reaching down to the bottomless depths of the ocean where coral reefs and seagrass beds, sand and mud bottoms lie. The island pulses with life and energy because water from rain storms rushes downhill to the coast, and species move quickly and easily back and forth between the two environments, taking with them sediments, nutrients, seeds, pollen, and other vital matter.

When people speak of Grand Etang and Annandale, the seemingly fragmented landscape is largely what Grenadians and visitor may perceive, but nature does not operate in this way—in fragments. For the two Reserves to function as thriving systems, they need the coastal habitats, the steep valleys, ponds, caves and overhangs, ghauts and ocean, the upland pools and springs, the species of birds, invertebrates and other fauna and flora that depend on them for survival.

The forests and other habitats of Grand Etang and Annandale have experienced considerable devastation since 1955, especially since the passage of Hurricanes Ivan in 2004 and Emily in 2005. These storms killed millions of plants and left the forests fragmented and impaired. The recovery is slow, and will take decades. Meanwhile, authorities continue to supplement nature's efforts with the introduction of non-native

species including Blue Mountain Mahoe (*Talipariti elatus*), hybrid Mahogany and Australian *Eucalyptus* spp.

But are these efforts effective? Are the forests recovering? Are the plants and animals able to survive within those borders? Are species moving freely and unencumbered up and down the valleys? Are adjustments to the current approach needed? How can authorities know?

These are critical questions, and the answers can only be gained through research and understanding.

Nevertheless, if the forests of the Grand Etang and Annandale Forest Reserves do not have corridors connecting them to other forested areas and to the coasts, then biodiversity will always be on the decline and many eventually disappear.

II/4.2. Issues and Targets: Recommendations

Table 10. Conservation Issues and Action Recommendations.

NO.	CONSERVATION ISSUE	STATUS	ACTION OPTIONS AND OTHER RECOMMENDATIONS
1	The need to develop a <i>viewpoint</i> (“ <i>philosophy</i> ”) of <i>place</i> .	There is little or no sense of place surrounding the creation and development of these two protected areas. This sense of organic aspiration and expression is critical to the long-term success of the Reserves/National Park.	Work with residents, artists, naturalists, communities, hunters, rangers and visitors to begin a process of engagement and evaluation and to encourage and forge a natural identity and governing philosophy for the Reserves/National Park.
2	The need to develop corridors and buffers connecting other forest tracts and valleys leading to the coasts.	Though Grand Etang and Annandale are connected in an intricate layout, they are fragmented forests and landscapes and require a connective network of managed corridors and buffer zones.	Develop an integrated management system of corridors and buffer zones that link coastal dry forests, woodlands, ponds, rivers and the ocean, and other vegetation communities to the north, east and south.
3	Essential requirement to study and document native and naturalised plant species and determine their conservation status within the Forest Reserves/National Park.	<p>The baseline survey highlighted a few first records for Grenada, and further field surveys and assessments would likely point to new species and records for Grenada. If efforts are not made now to document these species, then many could be at risk and go extinct even before they are known</p> <p>The current biodiversity overview was not sufficiently detailed to identify and document many of the species that occur within and adjacent to the Reserves.</p> <p>Further survey efforts need to expand on the current biodiversity assessment, with sufficient resources to provide for a long-term study strategy.</p>	<p>Further initiatives should be undertaken as soon as possible to document native and naturalised plant species and to determine their conservation status; such efforts should include management and conservation options for critical species.</p> <p>Of special importance are:</p> <ul style="list-style-type: none"> ▪ A complete list of species of the Reserves and nearby areas; ▪ A comprehensive survey of orchids; ▪ A comprehensive survey of ferns; ▪ A comprehensive survey of lichens; mosses, liverworts and fungi; ▪ A comprehensive assessment of endemic and regional restricted species. ▪ The development of a comprehensive and updated vegetation communities assessment ▪ Additional systematic surveys of the flora and fauna of the Reserves and surrounding areas.
4	The need to undertake a biodiversity status assessment and from this process, to develop a plan and strategy for wildlife management within and adjacent to the Reserves.	From discussions with Forestry Department personnel, it appears that only tree species of forestry importance are being identified and monitored. In order to manage the two forest reserves effectively, it is necessary to monitor a much broader range of species and habitats.	<p>A biodiversity status assessment needs to be done. From this process, a plan and strategy for wildlife management within and adjacent to the Reserves needs to be undertaken.</p> <p>Target areas for biodiversity should include:</p> <ul style="list-style-type: none"> ▪ Hunting and hunters ▪ Assessment and monitoring of game species ▪ Assessment and status of amphibians and reptiles ▪ Survey of invertebrates

NO.	CONSERVATION ISSUE	STATUS	ACTION OPTIONS AND OTHER RECOMMENDATIONS
			<ul style="list-style-type: none"> ▪ Survey and assessment of freshwater fauna ▪ Survey and assessment of bats ▪ Assessment and mapping of the health and stressors on forest ecosystems in the reserves.
5	The need for comprehensive watershed assessment.	<p>Although it is recognised that both Forest Reserves are important sources of water for use by St George's and surrounding communities, as well as for scenic purposes, little evaluation appears to have been carried out on assessing the water yields and their responses to changing forest vegetation.</p> <p>For example, the source(s) of sulphurous water in the Beausejour drainage system do not seem to be properly identified, despite the smell of sulphur at several points in the valley.</p>	<p>The watersheds of the Reserves and nearby areas need a comprehensive assessment of the water resources, including:</p> <ul style="list-style-type: none"> ▪ Water runoff, discharge, groundwater recharge, groundwater quality and characteristics, springs, etc. ▪ Soils ▪ Accurate and detailed geology ▪ Landslip/landslide occurrence, distribution and vulnerability ▪ Sediment runoff and soil conservation ▪ More accurate and consistent weather data, including rainfall, mist and humidity distribution.
6	The need for comprehensive digital mapping of resources, along with a parallel effort in GIS capacity, within the Forestry Department.	Long lead times to secure products from a largely unknown database of geographic information resources.	<ul style="list-style-type: none"> ▪ Continued upgrading of remote sensing product acquisitions, open access, cataloguing, and analysis capabilities of Government's Geographic Information Systems unit. ▪ Development of desktop GIS display capabilities in the Forestry Department. ▪ Development of GPS surveying and mapping skills for field staff of the Forestry Department.
7	Need for Forestry personnel training in biodiversity survey methods, assessment and monitoring, especially for rangers.	<p>Little systematic input by Forest Department to resource cataloguing and mapping.</p> <p>Occasional work on individual projects.</p>	Training in association with extended monitoring and field survey work for recommended comprehensive assessments.
8	Need to prepare a plan for plant species and critical plant habitats.	Little ground-truthed forest classification mapping; no mapping or prioritisation of stressors; no assessment of classes or sites.	This recommendation is a later step in the process; the operational version may be only after four or five years of monitoring, study and assessment activity. Should be a key part of National Action Plans for Biodiversity Conservation.
9	Need to undertake taxonomic review of the Armadillo and the two opossum species of the island.	Conflicting literature reports, expert suggestions and limited field data provide little in the way of resolving the true taxonomic status of these three species of mammals.	This recommendation is critical, especially given the priority placed by the Government on these species, the implications for conservation and management and the significance of these animals to the local culture and diet.

NO.	CONSERVATION ISSUE	STATUS	ACTION OPTIONS AND OTHER RECOMMENDATIONS
10	The need to encourage research and interpretation of French and patois names of landscape features, places, practices and species, and to develop a map of place names reflecting the multiple cultures that have lived in Grenada.	<p>Many names, cultural practices, features and species have French and French-derived names and connections, but most residents do not know their meaning.</p> <p>Confusion arises in discussing geographic conditions and impacts because of multiple names used by different groups.</p>	<p>The lack of understanding and appreciation for the island's cultural and historical French roots has serious implications for conservation. Many of the practices, expressions, uses, ideas and species names are either in French or have French origins. Knowing the history, application, cultural meaning and interpretation of certain terms can help in the conservation of species and landscapes and can promote greater community awareness, participation, sense of ownership and pride, and highlights the rich cultural heritage of Grenada.</p> <p>This should be combined with a detailed map (at least around the Forest Reserves) of common place names.</p>

As a result of discussions with stakeholders in Grenada, it was decided that the IRF team would prepare concept papers for draft summary proposals, including staffing and cost estimates, for both a comprehensive biodiversity survey and a watershed assessment. The Grenada proposals are appended in Appendices 7 and 8, Part II of this report.

II/5. Preliminary List of Environmental Expert Consultants

Table 11. Preliminary List of Environmental Expert Consultants for Grenada.

Area of Expertise:	Name and Affiliation
Plants	<p>Pedro Acevedo, PhD, Smithsonian Institution, Washington, DC; ACEVEDOP@si.edu</p> <p>Sean Carrington, PhD, University of the West Indies, Barbados; sean.carrington@cavehill.uwi.edu</p> <p>Yasmin S. Baksh-Comeau, PhD, University of the West Indies, Trinidad; Yasmin.Baksh-Comeau@sta.uwi.edu</p> <p>Paul L. Comeau, Trinidad (husband of Dr. Yasmin S. Baksh-Comeau); Colin Clubbe, PhD, Royal Botanic Gardens at Kew; c.clubbe@kew.org.uk</p>
Ferns	<p>Alan Smith, PhD, University Herbarium, University of California USA; arsmith@uclink4.berkeley.edu</p> <p>Dr. John T. Mickel (retired), New York Botanical Garden USA; jmickel@nybg.org</p>
Orchids	<p>Philippe Feldmann, PhD, France/Guadeloupe; philippe.feldmann@cirad.fr</p>
Vegetation	<p>The Nature Conservancy, Virgin Islands/Caribbean Programme Office, 3052 Estate Little Princess, Christiansted, St. Croix, USVI; Phone: (340) 773-5575;</p> <p>Peter Weaver, PhD, International Institute of Tropical Forestry, USDA Forest Service, San Juan, Puerto Rico; pweaver@fs.fed.us</p> <p>Kevel Lindsay (klindsay@irf.org) and Jean Pierre Bacle (dcbacle@aol.com), Island Resources Foundation;</p> <p>International Institute for Tropical Forestry, USDA Forest Service, San Juan, Puerto Rico; Phone: (787) 766-5335</p> <p>Barry Devine, PhD, St. John, USVI, and Rhode Island, USA; bdevine3485@gmail.com</p>
Invertebrates	<p>Michael Ivie, PhD, Montana State University (beetle specialist), 1601 South 19th Street, Room 50, Bozeman, MT 59717 USA, Phone: (406) 994-4610; mivie@montana.edu</p> <p>The Conservation Agency, 6 Swinburne Street, Jamestown, Rhode Island, 02835 USA Phone and Fax: (401) 423-2652; 67 Howland Avenue, Jamestown, Rhode Island 02835; Phone: (401) 835-1400; Contact Dr. Skip Lazell, President</p>
Birds	<p>Lisa Sorenson, PhD, President, Society for the Conservation and Study of Caribbean Birds (SCSCB); lsoren@bu.edu</p>

	Andrew Dobson, Past-President, Bermuda Audubon Society, as contact for several SCSCB expert members; Andrewdobs@gmail.com
Mammals (mostly bats)	Gary Kwiecinski, PhD, University of Scranton, Pennsylvania USA; ggk301@scranton.edu Scott Pedersen, PhD, South Dakota State University USA; scott_pedersen@sdstate.edu Hugh Genoways, PhD (retired), University of Nebraska-Lincoln USA; hgenoway@unl.edu ; hgenoway@unlserve.unl.edu
Reptiles	Jenny Daltry, PhD, Fauna and Flora International, UK; jenny.daltry@gmail.com Matthew Morton, PhD, Durrell Wildlife Conservation Trust, UK; mmorton@fastmail.fm Renata Platenberg, PhD, Division of Fish & Wildlife, St. Thomas, USVI; platenberg@gmail.com ; vi.wildlife@gmail.com Skip Lazell, PhD, Conservation Agency; hq@theconservationagency.org ; wenhua3gs@gmail.com Gad Perry, PhD, Dept. of Natural Resources Management, Texas Tech University USA; gad.perry@ttu.edu
Fungi (regional experts not known directly to IRF team)	Gaston Guzman, PhD; Fidel Tapia Florencia, PhD; and Ramirez-Guillen, PhD; Instituto de Ecología, Apartado Postal 63, Xalapa, Veracruz 91000, Mexico; Timothy J. Baroni, PhD, Department of Biological Sciences, State University of New York, College at Cortland, Cortland, New York; D. Jean Lodge, PhD, Center for Forest Mycology Research, U.S.D.A. Forest
Mosses, Liverworts & other material	William R. Buck, PhD, Institute of Systematic Botany, New York Botanical Garden USA; bbuck@nybg.org
Ecology	Peter Weaver, PhD, IITF, Puerto Rico (see entry above); Ariel Lugo, PhD, IITF, Puerto Rico; alugo@fs.fed.us Ann Haynes, PhD, Sutton, Jamaica; asutton@cwjamaica.com ; asutton@uwimona.edu.jm Lianna Jarecki, PhD, H. Lavity Stoutt Community College, British Virgin Islands; ljarecki@email.hlsc.edu.vg
Heritage & Cultural Resources	Reginald Murphy, PhD, Nelson's Dockyard National Park, Antigua; regmurphy@hotmail.com
Writing Scientific Papers/Manuscripts	Dr. Jenny Daltry, FFI (see entry above); Matthew Morton, DWPT (see entry above); Dr. Renata Platenberg, DFW, USVI (see entry above); Dr. Gad Perry, Texas Tech University (see entry above);

	<p>Dr. Gary Kwiecinski, University of Scranton (see entry above); Dr. Sean Carrington, University of the West Indies, Barbados; Dr. Yasmin S. Baksh-Comeau, University of the West Indies, Trinidad; University of Puerto Rico; International Institute of Tropical Forestry; University of Guyana; University of the Virgin Islands</p>
<p>GIS Expert</p>	<p>Barry Devine, PhD, St. John, USVI and Rhode Island USA; bdevine3485@gmail.com Carlos Ramos, PhD, Island Resources Foundation, Texas and Puerto Rico; cramos_scharron@yahoo.com; cramos@irf.org Kimberly Baldwin, PhD Candidate, University of the West Indies, Barbados; baldwin.kimberly@gmail.com; kimberly_baldwin@hotmail.com</p>
<p>Watersheds, Soils & Water</p>	<p>Barry Devine, PhD, St. John, USVI and Rhode Island; Carlos Ramos, PhD, Island Resources Foundation, Texas and Puerto Rico; cramos_scharron@yahoo.com; cramos@irf.org</p>

APPENDIX 1

List of Birds of Grand Etang and Annandale Forest Reserves

January 2011

NO.	COMMON NAMES	SPECIES	HABITAT	
1	Little Blue Heron	<i>Egretta caerulea</i>		(A)
2	Cattle Egret	<i>Bubulcus ibis</i>		
3	Green Heron	<i>Butorides virescens</i>		
Storks: Ciconiidae				
Hawks, kites & Eagles: Accipitridae				
4	Hook-billed Kite	<i>Chondrohierax uncinatus</i>		
5	Northern Harrier	<i>Circus cyaneus</i>		
6	Common Black-Hawk	<i>Buteogallus anthracinus</i>		(A)
7	Broad-winged Hawk	<i>Buteo platypterus</i>		(A)
Caracaras & Falcons: Falconidae				
8	American Kestrel	<i>Falco sparverius</i>		(A)
9	Merlin	<i>Falco columbarius</i>		(A)
10	Peregrine Falcon	<i>Falco peregrinus</i>		
Guans, Chachalacas & Allies: Cracidae				
Avocets & Stilts: Recurvirostridae				
11	Scaly-naped Pigeon	<i>Patagioenas squamosa</i>		
12	Eared Dove	<i>Zenaida auriculata</i>		
13	Zenaida Dove	<i>Zenaida aurita</i>		
14	Common Ground-Dove	<i>Columbina passerina</i>		
15	Ruddy Quail-Dove	<i>Geotrygon montana</i>		
Cuckoos & Anis: Cuculidae				
16	Mangrove Cuckoo	<i>Coccyzus minor</i>		
17	Dark-billed Cuckoo	<i>Coccyzus melacoryphus</i>		(A)

NO.	COMMON NAMES	SPECIES	HABITAT	
18	Smooth-billed Ani	<i>Crotophaga ani</i>		
Barn Owls: Tytonidae				
19	Grenadian Barn Owl	<i>Tyto alba insularis</i>		
Swifts: Apodidae				
20	Black Swift	<i>Cypseloides niger</i>		(A)
21	White-collared Swift	<i>Streptoprocne zonoris</i>		(A)
22	Gray-rumped Swift	<i>Chaetura cinereiventris</i>		
23	Short-tailed Swift	<i>Chaetura brachyura</i>		
Hummingbirds: Trochilidae				
24	Rufous-breasted Hermit	<i>Glaucis hirsuta</i>		
25	White-necked Jacobin	<i>Florisuga mellivora</i>		
26	Green-throated Mango	<i>Anthracothorax viridigula</i>		
27	Purple-throated Carib	<i>Eulampis jugularis</i>		
28	Green-throated Carib	<i>Eulampis holosericeus</i>		
29	Antillean Crested Hummingbird	<i>Orthorhyncus cristatus</i>		
Kingfishers: Alcedinidae				
30	Belted Kingfisher	<i>Ceryle alcyon</i>		(A)
Tyrant Flycatchers: Tyrannidae				
31	Caribbean Elaenia	<i>Elaenia martinica</i>		
32	Yellow-bellied Elaenia	<i>Elaenia flavogaster</i>		
33	Euler's Flycatcher	<i>Lathrotriccus euleri flaviventris</i>		(Ex?)*
34	Grenada Flycatcher	<i>Myiarchus nugator</i>		(E)
35	Tropical Kingbird	<i>Tyrannus melancholicus</i>		(A)
36	Gray Kingbird	<i>Tyrannus dominicensis</i>		
Swallows & Martins: Hirundinidae				
37	Caribbean Martin	<i>Progne dominicensis</i>		
38	White-winged Swallow	<i>Tachycineta albiventer</i>		(A)

NO.	COMMON NAMES	SPECIES	HABITAT	
39	Bank Swallow	<i>Ripariariparia</i>		(A)
40	Barn Swallow	<i>Hirundorustica</i>		
Mockingbirds & Thrashers: Mimidae				
41	Brown Trembler	<i>Cinlocerthia ruficauda</i>		(A)
42	Scaly-breasted Thrasher	<i>Alenia fusca</i>		(A)
43	Pearly-eyed Thrasher	<i>Margarops fuscatus</i>		
Thrushes & Allies: Turdidae				
44	Gray-cheeked Thrush	<i>Catharus minimus</i>		
45	Cocoa Thrush	<i>Turdus fumigatus</i>		
46	Bare-eyed Thrush	<i>Turdus nudigenis</i>		
Vireos: Vireonidae				
47	Yellow-throated Vireo	<i>Vireo flavifrons</i>		(A)
48	Black-whiskered Vireo	<i>Vireo altiloquus</i>		
New World Warblers: Parulidae				
49	Northern Parula	<i>Parula americana</i>		(A)
50	Yellow Warbler	<i>Dendroica petechia</i>		
51	Cape May Warbler	<i>Dendroica tigrina</i>		(A)
52	Blackburnian Warbler	<i>Dendroica fusca</i>		(A)
53	Prairie Warbler	<i>Dendroica discolor</i>		(A)
54	Blackpoll Warbler	<i>Dendroica striata</i>		(A)
55	Black-&-white Warbler	<i>Mniotilta varia</i>		
56	American Redstart	<i>Setophaga ruticilla</i>		(A)
57	Prothonotary Warbler	<i>Protonotaria citrea</i>		(A)
58	Northern Waterthrush	<i>Seiurus noveboracensis</i>		(A)
59	Louisiana Waterthrush	<i>Seiurus motacilla</i>		
Bananaquit: Coerebidae				
60	Bananaquit	<i>Coereba flaveola</i>		

NO.	COMMON NAMES	SPECIES	HABITAT	
Tanagers: Thraupidae				
61	Scarlet Tanager	<i>Piranga olivacea</i>		(A)
62	Summer Tanager	<i>Piranga rubra</i>		(A)
63	Antillean Euphonia	<i>Euphonia musica</i>		(A)
64	Lesser Antillean Tanager	<i>Tangara cucullata</i>		(E)
Buntings, Sparrows, Seedeaters & Allies: Emberizidae				
65	Blue-black Grassquit	<i>Volatinia jacarina</i>		
66	Yellow-bellied Seedeater	<i>Sporophila nigricollis</i>		(A)
67	Black-faced Grassquit	<i>Tiaris bicolor</i>		
68	Lesser Antillean Bullfinch	<i>Loxigilla noctis</i>		
69	Grassland Yellow-Finch	<i>Sicalis luteola</i>		(A)
Saltators, Cardinals & Allies: Cardinalidae				
70	Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>		
Troupials & Allies: Icteridae				
71	Bobolink	<i>Dolichonyx oryzivorus</i>		(A)
72	Carib Grackle	<i>Quiscalus lugubris</i>		
73	Shiny Cowbird	<i>Molothrus bonariensis</i>		
74	Venezuelan Troupial	<i>Icterus icterus</i>		(A)
75	Baltimore Oriole	<i>Icterus galbula</i>		(A)

Legend:

- (A) **Accidental:** A species that rarely or accidentally occurs in Grenada.
- (E) **Endemic:** A species endemic to Grenada.
- (I) **Introduced:** A species introduced to Grenada as a consequence, direct or indirect, of human actions.
- (Ex) **Extirpated:** A species that no longer occurs in Grenada although populations exist elsewhere.
- * Exact Conservation status of species remains uncertain at this point.

Online Sources:

- List of Birds of Grenada: http://en.wikipedia.org/wiki/List_of_birds_of_Grenada
- Birds of Grenada: http://en.wikipedia.org/wiki/Category:Birds_of_Grenada
- Avibase – Bird Checklist of the World: Grenada: <http://avibase.bsc-eoc.org/checklist.jsp?region=gd&list=howardmoore>

APPENDIX 2

List of Plants of Grand Etang and Annandale Forest Reserves

DICOT TREES & SHRUBS				
FAMILY	TAXON	COMMON NAME	FORM	NOTES
Acanthaceae	<i>Odontenema nitidum</i>		Shrub	
	<i>Justicia secunda</i>		Shrub	
	<i>Mangifera indica</i>		Tree	Introd
Anacardiaceae	<i>Spondias mombin</i>	Hog Plum	Tee	Introd?
Annonaceae	<i>Guatteria caribaea</i>		Tree	
Aquifoliaceae	<i>Ilex dioica</i>		Tree	
	<i>Ilex sideroxyloides</i>		Shrub	
	<i>Tabernaemontana citrifolia</i>		Tree	
	<i>Scheffleria attenuata</i>		Tree	
Asteraceae	<i>Neurolaena lobata</i>		Shrub	
	<i>Pluchea carolinensis</i>		Shrub	
Bignoniaceae	<i>Bourreria succulenta</i>		Tree	
	<i>Cordia alliodora</i>	Cypre	Tree	
	<i>Cordia sulcata</i>		Tree	
	Unknown species		Tree	Introd/Cultivated
Burseraceae	<i>Dacryodes excelsa</i>		Tree	
Capparaceae	<i>Capparis baducca</i>		Shrub	
	<i>Capparis cynophallophora</i>		Tree	
	<i>Capparis flexuosa</i>		Tree	
Caricaceae	<i>Carica papaya</i>	Papaya, Paw Paw	Tree	
Casuarinaceae	<i>Casuarina</i> sp.		Tree	
Cecropiaceae	<i>Cecropia schreberiana</i>	Trumpet	Tree	
Celastraceae	<i>Cassine xylocarpa</i>		Tree	
	<i>Maytenus grenadensis</i>		Tree	Endemic
Chrysobalanaceae	<i>Hirtella triandra</i>		Tree	
	<i>Licania ternatensis</i>		Tree	
Clusiaceae	<i>Clusia major</i>		Tree	
	<i>Calophyllum calaba</i>		Tree	
	<i>Mammea americana</i>	Mamee Apple	Tree	
	<i>Vismia</i> sp.		Tree	First recorded by Hawthorne et al in 2003. The taxonomy of this species remains unclear.
Elaeocarpaceae	<i>Sloanea massonii</i>		Tree	

	<i>Sloanea caribaea</i>		Tree	
Euphorbiaceae	<i>Richeria grandis</i>		Tree	
	<i>Sapium caribaeum</i>		Tree	
	<i>Hieronyma alchoreoides</i> var. <i>alchoreoides</i>		Tree	
Gesneriaceae	<i>Besleria lutea</i>		Shrub	
	<i>Crantzia cristata</i>		Shrub	
Goodeniaceae	<i>Scaevola sericea</i>		Shrub	
Lauraceae	<i>Cinammomum elongata</i>		Tree	
	<i>Cinammomum verum</i>	Cinnamon Tree	Tree	Introd
	<i>Nectandra hihua</i>		Tree	
	<i>Ocotea floribunda</i>		Tree	
	<i>Ocotea leucoxydon</i>		Tree	
	<i>Ocotea martinicensis</i>		Tree	
Leguminosae-Caesalpinioideae	<i>Delonix regia</i>		Tree	Introd
	<i>Hymenaea courbaril</i>		Tree	
	<i>Senna alata</i>		Shrub	
	<i>Senna bicapsularis</i>		Shrub	
	<i>Senna obtusifolia</i>		Shrub	
	<i>Chamaecrista glandulosa</i> var. <i>swartzii</i>		Shrub	
	<i>Tamarindus indica</i>		Tree	Introd
Leguminosae-Faboideae	<i>Andira inermis</i>		Tree	
	<i>Erythrina glauca</i>		Tree	
	<i>Erythrina micropteryx</i>		Tree	
	<i>Flemingia strobilifera</i>	Wild hops	Shrub	Introd
	<i>Gliricida sepium</i>		Tree	Introd
	<i>Ormosia monosperma</i>		Tree	
	<i>Piscidia carthagenensis</i>		Tree	
	<i>Sesbania</i> sp.		Shrub	
	<i>Sesbania</i> sp.		Shrub	
	<i>Sesbania</i> sp.		Shrub	
Leguminosae-Mimosoideae	<i>Adenantha pavonia</i>	Sandal wood	Tree	Introd
	<i>Inga edulis</i>		Tree	
	<i>Inga laurina</i>		Tree	
	<i>Pentaclethra macroloba</i>	Poix Doux	Tree	Introd
	<i>Pithecellobium jupunba</i>		Tree	
	<i>Zygia latifolia</i>		Tree	Introd

Malpighiaceae	<i>Brysonima spicata</i>		Tree	
	<i>Byrsonima trinitensis</i>		Tree	
Malvaceae	<i>Malachra alceifolia</i>		Shrub	
	<i>Pavonia spinifex</i>		Shrub	
	<i>Sida acuta</i>		Shrub	
	<i>Sida</i> sp.		Shrub	
	<i>Sidastrum multiflorum</i>		Shrub	
	<i>Talipariti elatum</i>	Blue Mahoe/Blue Mountain Mahoe	Tree	Introd
	<i>Talipariti tiliaceum</i> var. <i>pernambucense</i>	Mahaut Mang	Tree	Introd?
	<i>Urena lobata</i>		Shrub	
Malvaceae/Bombacaceae	<i>Ceiba pentandra</i>	Silk cotton	Tree	
	<i>Ochroma pyramidale</i>		Tree	
	<i>Pachira insignis</i>	Chataigne Marron	Tree	Introd
	<i>Quararibea turbinata</i>	Swizzle Stick	Tree	
Malvaceae/Sterculiaceae	<i>Guazuma ulmifolia</i>		Tree	
	<i>Melochia nodiflora</i>		Shrub	
	<i>Melochia tomentosa</i>		Shrub	
	<i>Waltheria indica</i>		Shrub	
Malvaceae/Tiliaceae	<i>Triumfetta lappula</i>		Shrub	
Melastomataceae	<i>Charianthus purpureus</i> var. <i>brevisetosus</i>		Shrub/Tree	
	<i>Clidemia hirta</i>		Shrub	
	<i>Conostegia icosandra</i>		Tree	
	<i>Miconia</i> cf. <i>furfurcea</i>		Shrub	This ID is tentative, and is not convincing since the species observed is pilose and may represent an unknown <i>Tetraggia</i> .
	<i>Miconia mirabilis</i>		Shrub/Tree	
	<i>Miconia andersonii</i>		Shrub	
	<i>Miconia prasina</i>		Shrub	
	<i>Miconia racemosa</i>		Shrub	
	<i>Miconia</i> sp.		Shrub	
	<i>Miconia trichotoma</i>		Shrub	
Meliaceae	<i>Carapa guianensis</i>		Tree	
	<i>Guarea macrophylla</i>		Tree	
	<i>Swietenia macrophylla</i>	Honduras Mahogany	Tree	Cult/Introd
	<i>Swietenia mahogany</i> x <i>macrophylla</i>	Hybrid Mahogany	Tree	Cult/Introd
	<i>Trichillia septentrionalis</i>		Tree	

Monimiaceae	<i>Siparuna</i> sp.		Tree	A new record for the island. The ID here is tentative. The closest possible species is <i>Siparuna glabrescens</i> , a species endemic to the Windwards from Dominica to St. Vincent. However, the morphology of this species does not fit with this species and further work needs to be done to confirm its taxonomy.
Moraceae	<i>Ficus americana</i>		Tree	
	<i>Ficus citrifolia</i>		Tree	
Myrsinaceae	<i>Cybianthus antillanus</i>		Tree	
	<i>Myrsine coriacea</i>		Tree	
	<i>Myrsine guianensis</i>		Tree	
	<i>Stylogyne lateriflora</i>		Tree	
	<i>Stylogyne canaliculata</i>		Tree	
Myrtaceae	<i>Eugenia jambos</i>	Pomme Rose	Tree	Introd
	<i>Eugenia malaccensis</i>	Pomerac	Tree	Introd
	<i>Eugenia monticola</i>		Tree	
	<i>Eugenia</i> sp.		Tree	
	<i>Marliera guildingiana</i>		Tree	
	<i>Myrcia</i> cf. <i>platyclada</i>		Tree	
	<i>Pimenta racemosa</i>	Cinnamon	Tree	Introd
	<i>Syzygium aromaticum</i>	Clove Tree	Tree	Introd
	<i>Szygium jambos</i>		Tree	Introd
Olacaceae	<i>Schoepfia schreberi</i>		Tree	
Nyctaginaceae	<i>Pisonia aculeata</i>		Tree	
	<i>Pisonia subcordata</i>		Tree	
Phyllanthaceae	<i>Phyllanthus epiphyllanathus</i>		Shrub	
Piperaceae	<i>Piper dilatatum</i>	Malambe	Shrub	
	<i>Piper reticulatum</i>		Shrub	
Plumbaginaceae	<i>Plumbago scandens</i>		Shrub	
Polygonaceae	<i>Coccoloba pubescens</i>		Tree	
	<i>Coccoloba swartzii</i>		Tree	
	<i>Coccoloba uvifera</i>		Tree	
	<i>Coccoloba venosa</i>		Tree	
Protaceae	<i>Roupala montana</i>	Bois/Bwa Bande	Tree	Introd?
Rhizophoraceae	<i>Cassipourea guianensis</i>		Shrub	
Rubiaceae	<i>Chiococca</i> sp.		Tree	
	<i>Erithalis fruticosa</i>		Tree	
	<i>Faramea occidentalis</i>	Wild coffee	Tree	
	<i>Gonzalagunia hirsuta</i>		Tree	

	<i>Guettarda scabra</i>		Tree	
	<i>Hillia parasitica</i>		Shrub/Vine	
	<i>Ixora ferrea</i>		Tree	
	<i>Malanea macrophylla</i>		Shrub/Vine	
	<i>Palicourea crocea</i> ????		Shrub	
	<i>Palicourea cf. croceoides</i>		Shrub	
	<i>Psychotria beteteriana</i>		Shrub	
	<i>Psychotria capitata</i>		Shrub	
	<i>Psychotria muscosa</i>		Shrub	
	<i>Psychotria uliginosa</i>		Shrub	
	<i>Rondeletia parviflora</i>		Shrub	
	<i>Rudgea hostmanniana</i>		Tree	
	<i>Rudgea vincentina</i>		Tree	
Rutaceae	<i>Citrus aurantium</i>		Tree	Introd
	<i>Amyris elemifera</i>		Tree	
	<i>Triphasia trifolia</i>	Myrtle lime	Shrub	
	<i>Zanthoxylum martinicense</i>		Tree	
	<i>Zanthoxylum microcarpum</i>	Zel Mouch	Tree	
	<i>Zanthoxylum punctatum</i>		Tree	
	<i>Zanthoxylum monophyllum</i>		Tree	
Sabiaceae	<i>Meliosma herbertii</i>		Tree	
Salicaceae	<i>Samyda dodecandra</i>	Wild guava	Tree	
Sapindaceae	<i>Melicoccus bijugatus</i>	Guinep	Tree	Introd
Simaroubiaceae	<i>Simarouba amara</i>		Tree	
	<i>Quassia amara</i>	Marouba	Tree	Introd
Sapotaceae	<i>Chrysophyllum argenteum</i>		Tree	
	<i>Manilkara bidentata</i>		Tree	
	<i>Micropholis guyanensis</i> var. <i>guyanensis</i>		Tree	
	<i>Pouteria multiflora</i>		Tree	
	<i>Pouteria pallida</i>		Tree	
	<i>Pouteria sapota</i>	Mamey Sapote	Tree	Introd
	<i>Pouteria semecarpifolia</i>	Contrevent	Tree	
Solanaceae	<i>Solanum torvum</i>	Wild Egg	Shrub	
Symplocaceae	<i>Symplocos martinicensis</i>		Tree	
Theaceae	<i>Freziera undulata</i>		Shrub	
Theophrastaceae	<i>Jacquinia armillaris</i>		Tree	

	<i>Jacqinia berterii</i>		Tree	
Ulmaceae	<i>Trema macracantha</i>		Tree	
Urticaceae	<i>Urera baccifera</i>		Shrub	
Verbenaceae	<i>Citharexylum fruticosum</i>		Tree	
	<i>Lantana camara</i>		Shrub	
	<i>Stachytarpheta cayennensis</i>	Vervain	Shrub	Introd?

DICOT VINES & CLIMBERS				
FAMILY	TAXON	COMMON NAME	FORM	NOTES
Asteraceae	<i>Mikania micrantha</i>		Vine	
Celastraceae	<i>Hippocratea volubilis</i>		Vine	
Convolvulaceae	<i>Cuscuta americana</i>		Vine	
	<i>Ipomoea indica</i>		Vine	
	<i>Ipomoea tiliacea</i>		Vine	
	<i>Meremia quinquefolia</i>		Vine	
	<i>Merremia umbellata</i>		Vine	
	<i>Stictocardia tiliifolia</i>		Vine	
	<i>Turbina corymbosa</i>		Vine	
	<i>Poranopsis paniculata</i>		Vine	
Cucurbitaceae	<i>Cayaponia americana</i>		Vine	
	<i>Cayaponia racemosa</i>		Vine	
	<i>Melothria pendula</i>		Vine	
	<i>Momordica charantia</i>	Wash Woman, Lizard Food	Vine	Cult
	<i>Sechium edule</i>	Christophine	Vine	Cult
Dilleniaceae	<i>Pinzona coriacea</i>	Water Vine	Vine	Previously unrecorded for Grenada.
Euphorbiaceae	<i>Tragia volubilis</i>	Stinging nettle	Vine	
Leguminosae-Caesalpinioideae	<i>Caesalpinia bonduc</i>		Climber	
Leguminosae-Faboideae	<i>Abrus precatorius</i>		Vine	
	<i>Centrosema pubescens</i>		Vine	
	<i>Centrosema virginianum</i>		Vine	
	<i>Dioclea megacarpa</i>	Donkey Eye	Vine	
	<i>Lablab purpureus</i>		Vine	
	<i>Mucuna pruriens</i>		Vine	
	<i>Pueraria phaseoloides</i>	Kudzu	Vine	Introd/Invasive
Malpighiaceae	<i>Mascagnia sinemariensis</i>		Vine	
	<i>Stigmaphyllon</i> sp.	?	Vine	
Marcgraviaceae	<i>Marcgravia umbellata</i>		Vine	
Menispermaceae	<i>Cissampelos pareira</i>	Velvet leaf	Vine	
Oleaceae	<i>Jasminum fluminense</i>		Vine	Introd
Passifloraceae	<i>Passiflora edulis</i>		Vine	
	<i>Passiflora quadrilandulosa</i>		Vine	Introd?

	<i>Passiflora laurifolia</i>		Vine	
	<i>Passiflora rubra</i>		Vine	
	<i>Passiflora suberosa</i>		Vine	
Polygonaceae	<i>Antigonon leptopus</i>	Coralita	Vine	Introd
Rhamnaceae	<i>Gouania lupuloides</i>	Chew Stick	Vine	
Rubiaceae	<i>Chiococca alba</i>		Vine	
Ulmaceae	<i>Celtis iguanaea</i>		Vine	
Verbenaceae	<i>Petrea kahautiana</i>		Vine	
Vitaceae	<i>Cissus obovata</i>		Vine	Not previously reported for the island.
	<i>Cissus verticillata</i>		Vine	

HERBACEOUS PLANTS				
FAMILY	TAXON	COMMON NAME	FORM	NOTES
Acanthaceae	<i>Asystasia gangetica</i>	Chinese Violet	Herb	Introd
	<i>Blechum pyramidatum</i>		Herb	
	<i>Justicia pectoralis</i>		Herb	
	<i>Justicia sessilis</i>		Herb	
	<i>Justicia sp.</i>		Herb	
	<i>Ruellia tuberosa</i>		Herb	
Aizoaceae	<i>Sesuvium portulacastrum</i>		Herb	
Amaranthaceae	<i>Cyathula prostrata</i>	Man better one	Herb	
Apocynaceae	<i>Asclepias curassavicum</i>		Herb	
	<i>Catharanthus roseus</i>	Periwinkle	Herb	Introd
Asteraceae	<i>Ageratum conyzoides</i>		Herb	
	<i>Bidens cynapiifolia</i>		Herb	
	<i>Bidens pilosa</i>		Herb	
	<i>Centratherum punctatum</i>		Herb	
	<i>Emilia fosbergii</i>		Herb	Introd?
	<i>Lagascea mollis</i>		Herb	
	<i>Pseudelephantopus spicatus</i>		Herb	
	<i>Rolandra fruticosa</i>		Herb	
	<i>Synedrella nodiflora</i>		Herb	
	<i>Sphagneticola trilobata</i>		Herb	
	<i>Tithonia diversifolia</i>		Herb	
	<i>Xanthium strumarium</i>		Herb	
Boraginaceae	<i>Heliotropium angiospermum</i>		Herb	
	<i>Heliotropium curassavicum</i>		Herb	
	<i>Heliotropium indicum</i>		Herb	
Brassicaceae/Cruciferae	<i>Cakile lanceolata</i>		Herb	
	<i>Lepidum virginicum</i>		Herb	
Campanulaceae	<i>Centropogon cornutus</i>		Herb	

	<i>Hippobroma longiflora</i>		Herb	
	<i>Lobelia cirsiifolia</i>		Herb	
Capparaceae	<i>Cleome viscosa</i>		Herb	
Caryophyllaceae	<i>Drymaria cordata</i>		Herb	
Crassulaceae	<i>Bryophyllum pinnatum</i>	love bush	Herb	
Euphorbiaceae	<i>Croton lobatus</i>		Herb	
	<i>Jatropha gossypifolia</i>		Herb	
Gentianaceae	<i>Chelonanthus grandiflorus</i>		Herb	
Phyllanthaceae	<i>Phyllanthus amarus</i>		Herb	
	<i>Phyllanthus niruri</i>		Herb	
	<i>Phyllanthus urinaria</i>		Herb	
Lamiaceae	<i>Clerodendrum chinense</i>		Herb	Introd
Leguminosae-Faboideae	<i>Alysicapus viginalis</i>	Moneywort	Herb	
	<i>Desmodium adscendens</i>		Herb	
	<i>Desmodium incanum</i> var. <i>incanum</i>		Herb	
	<i>Vigna lutea</i>	Cow Pea	Herb	
Leguminosae-Mimosioideae	<i>Mimosa pudica</i>	sensitive plant	Herb	
	<i>Desmanthus virgatus</i>		Herb	
Malvaceae/Sterculiaceae	<i>Melochia pyramidata</i>		Herb	
Malvaceae/Tiliaceae	<i>Corchorus aestuans</i>		Herb	
Melastomataceae	<i>Clidemia hirta</i>		Herb	
	<i>Nespera aquatica</i>		Herb	
	<i>Pterolepis glomerata</i>		Herb	
Nymphaeaceae	<i>Nymphaea ampla</i>		Herb	
Ochnaceae	<i>Sauvagesia erecta</i>		Herb	
Onagraceae	<i>Ludwigia</i> cf. <i>leptocarpa</i>		Herb	
	<i>Ludwigia octovalis</i>		Herb	
Orobanchaceae	<i>Alectra aspera</i>		Herb	
Oxalidaceae	<i>Oxalis barrelieri</i>		Herb	
	<i>Oxalis corniculata</i>		Herb	
Papaveraceae	<i>Argemone americana</i>	Prickly poppy	Herb	
Phytolaccaceae	<i>Petiveria alliacea</i>	Stinking bush	Herb	
	<i>Rivina humilis</i>		Herb	
Piperaceae	<i>Peperomia</i> sp.		Herb	
Rubiaceae	<i>Notopleura guadalupensis</i> var. <i>guadalupensis</i>		Herb	
	<i>Spermacoce</i> sp.		Herb	
Solanaceae	<i>Browallia americana</i>		Herb	
	<i>Datura innoxia</i>		Herb	
	<i>Datura metel</i>		Herb	
	<i>Nicotiana tabacum</i>	Tobacco	Herb	
	<i>Solanum americanum</i>		Herb	
Turneraceae	<i>Turnera ulmifolia</i>	Yellow alder	Herb	
Umbelliferae	<i>Eryngium foetidum</i>	Clacla	Herb	

Urticaceae	<i>Urtica dioica</i>	Stinging Nettle	Herb	Introd?
Verbenaceae	<i>Priva lappulacea</i>		Herb	
	<i>Stachytarpheta jamaicensis</i>	Vervain	Herb	Introd?
	<i>Stachytarpheta urticifolia</i>	Vervain	Herb	
Zygollaceae	<i>Kallstroemia maxima</i>		Herb	

PTERIDOPHYTES			
FAMILY	TAXON	FORM	NOTES
Lycopodiaceae	<i>Huperzia taxifolia</i>	Herb	
Selaginellaceae	<i>Selaginella flabellata</i>	Herb	
Aspleniaceae	<i>Asplenium</i> cf. <i>auritum</i> var. <i>rigidum</i>	Herb	
	<i>Asplenium salicifolium</i>	Herb	
	<i>Asplenium</i> sp.	Herb	
Blechnaceae	<i>Blechnum x confluens</i>	Herb	
	<i>Blechnum polypodioides</i>	Herb	
Cyathaceae	<i>Cyathea arborea</i>	Tree	
	<i>Cyathea grandifolia</i> var. <i>obtusa</i>	Tree	
	<i>Cyathea tenera</i>	Tree	
Dryopteridaceae	<i>Elaphoglossum</i> cf. <i>latifolium</i>	Herb	
	<i>Elaphoglossum martinicense</i>	Herb	
	<i>Elaphoglossum</i> cf. <i>petiolatum</i>	Herb	
	<i>Polybotrya osmundacea</i>	Herb	
Gleicheniaceae	<i>Gleichenella pectinata</i>	Herb	
	<i>Sticherus bifidus</i>	Herb	
Hymenophyllaceae	<i>Didymoglossum angustifrons</i>	Herb	
	<i>Didymoglossum krausii</i>	Herb	
	<i>Didymoglossum</i> cf. <i>pusillum</i>	Herb	If the ID is confirmed, this would represent a new record for the island.
	<i>Hymenophylla hirsutum</i>	Herb	
	<i>Hymenophyllum</i> cf. <i>macrothecum</i>	Herb	
	<i>Hymenophyllum</i> cf. <i>polyanthos</i>	Herb	
	<i>Polyphlebium hymenophylloides</i>	Herb	
	<i>Trichomanes crispum</i>	Herb	
	<i>Trichomanes pinnatum</i>	Herb	
Lindsaeaceae	<i>Lindsaea</i> cf. <i>lancea</i>	Herb	
Lomariopsidaceae	<i>Nephrolepis rivularis</i>	Herb	
	<i>Nephrolepis</i> sp.	Herb	
Marattiaceae	<i>Danaea antillensis</i>	Herb	
	<i>Danaea elliptica</i>	Herb	
Polypodiaceae	<i>Campyloneurum</i> cf. <i>costatum</i>	Herb	
	<i>Campyloneurum</i> cf. <i>latum</i>	Herb	
	<i>Campyloneurum</i> sp.	Herb	

	<i>Cochlidium serrulatum</i>	Herb	
	<i>Microgramma</i> cf. <i>piloselloides</i>	Vine	
	<i>Microgramma polypodioides</i>	Vine	
	<i>Phlebodium aureum</i>	Herb	
	<i>Pecluma</i> sp.	Herb	
	<i>Pecluma</i> sp.	Herb	
	<i>Pleopeltis astrolepis</i>	Herb/Vine	
	<i>Pleopeltis polypodioides</i>	Vine	
	<i>Polypodium dulce</i>	Herb	
	<i>Serpocaulon dissimile</i>	Herb	
	<i>Serpocaulon loriceum</i>	Herb	
	<i>Serpocaulon triseriale</i>	Herb	
Psilotaceae	<i>Psilotum nudum</i>	Herb	
Pteridaceae	<i>Adiantum latifolium</i>	Herb	
	<i>Adiantum petiolatum</i>	Herb	
	<i>Adiantum obliquum</i>	Herb	
	<i>Adiantum</i> sp.	Herb	
	<i>Adiantum</i> sp.	Herb	
	<i>Adiantum tetraphyllum</i>	Herb	
	<i>Anetium citrifolium</i>	Herb	
	<i>Pityrogramma calomelanos</i>	Herb	
	<i>Polytaenium feei</i>	Herb	
	<i>Pteris</i> cf. <i>vittata</i>	Herb	
Tectariaceae	<i>Lastreopsis effusa</i> subsp. <i>divergens</i>	Vine	
Thelypteridaceae	<i>Thelypteris clypeolutata</i>	Herb	
	<i>Thelypteris dentata</i>	Herb	
	<i>Thelypteris hispidula</i>	Herb	
	<i>Thelypteris leptocladia</i>	Herb	
	<i>Thelypteris opposita</i>	Herb	
	<i>Thelypteris opulenta</i>	Herb	
	<i>Thelypteris poiteana</i>	Herb	
	<i>Thelypteris reticulata</i>	Herb	
	<i>Thelypteris tetragona</i>	Herb	

MONOCOTS				
FAMILY	TAXON	COMMON NAME	FORM	NOTES
Agavaceae	<i>Agave karrato</i>		Shrub	
	<i>Furcraea tuberosa</i>		Shrub	
	<i>Sansevieria</i> sp.		Herb	Introd
	<i>Scadoxus multiflorus</i>		Herb	Introd
Araceae	<i>Alocasia cucullata</i>		Herb	Introd
	<i>Anthurium acaule</i>		Herb	
	<i>Anthurium hookeri</i>		Herb	

	<i>Anthurium grandifolium</i>	Anthurium	Herb	
	<i>Anthurium</i> sp.		Herb	
	<i>Caladium bicolor</i>		Herb	Introd
	<i>Colocasia esculenta</i>	Dasheen	Herb	Introd
	<i>Dieffenbachia seguine</i>	Dumbcane	Herb	
	<i>Monstera deliciosa</i>		Vine	Introd?
	<i>Philodendron</i> sp.		Shrub	
	<i>Xanthosoma sagittifolium</i>	Tania	Herb	Cult/Introd
	<i>Xanthosoma</i> sp.		Herb	
Bromeliaceae	<i>Guzmania lingulata</i>		Herb	
	<i>Guzmania megastachya</i>		Herb	
Cannaceae	<i>Canna indica</i>	Lily	Herb	
Commelinaceae	<i>Commelina diffusa</i>	water grass, french weed	Herb	
	<i>Commelina elegans</i>	water grass, french weed	Herb	
Cyclanthaceae	<i>Asplundia insignis</i>		Vine/Shrub	
	<i>Asplundia minima</i>		Vine/Shrub	
	<i>Cyclanthus bipartitus</i>		Herb	
Cyperaceae	<i>Cyperus digitatus</i>		Herb	
	<i>Cyperus rotundus</i>		Herb	
	<i>Rhynchospora polyphylla</i>		Herb	
	<i>Scleria latifolia</i>		Herb	
	<i>Scleria secans</i>	Razor Grass	Herb	
	<i>Scleria</i> sp.		Herb	
Dioscoreaceae	<i>Dioscorea</i> cf. <i>altissima</i>		Vine	A new record for the island. This species is common throughout the forests of Grand Etang.
	<i>Dioscorea polygonoides</i>		Vine	Introd?
Heliconiaceae	<i>Heliconia bihai</i>		Shrub	
	<i>Heliconia caribaea</i>		Shrub	
	<i>Heliconia psittacorum</i>		Herb	Cult/Introd
Hydrocharitaceae	<i>Hydrilla verticillata</i>		Herb	Introd?
	<i>Vallisneria spiralis</i>		Herb	Introd?
Iridaceae	<i>Trimezia martinicensis</i>		Herb	
Maranthaceae	<i>Ischnosiphon arouma</i>		Shrub	
	<i>Marantha arundinacea</i>	Arrowroot	Herb	Introd
Musaceae	<i>Musa acuminata</i>	Red Fig	Herb	Introd
	<i>Musa acuminata</i> x <i>balbisiana</i>	Banana	Herb	Introd
	<i>Musa balbisiana</i>		Herb	Introd
	<i>Musa</i> x <i>paradisica</i>	Plantain	Herb	Introd
	<i>Musa</i> sp.	Rock Fig	Herb	Introd

Orchidaceae	<i>Camaridium reflexum</i>		Herb	
	<i>Cranichis muscosa</i>		Herb	
	<i>Dichaea cf. picta</i>		Herb	
	<i>Epidendrum fragrans</i>		Herb	Not previously reported
	<i>Epidendrum ramosum</i>		Herb	
	<i>Epidendrum rubroticum</i>		Herb	
	<i>Epidendrum tridens</i>		Herb	
	<i>Oeceoclades maculata</i>		Herb	
	<i>Oncidium altissimum</i>		Herb	
	<i>Ornithocephalus gladiatus</i>		Herb	
	<i>Polystachya concreta</i>		Herb	
	<i>Scaphyglottis cf. prolifera</i>		Herb	
	<i>Spathoglottis plicata</i>		Herb	Introd
	<i>Triphora surinamensis</i>		Herb	Not previously recorded
Palmae	<i>Acrocromia aculeata</i>	Coconut	Tree	
	<i>Cocos nucifera</i>		Tree	Introd
	<i>Euterpe broadwayi</i>	Mountain cabbage palm	Tree	
	<i>Prestoea montana</i>		Tree	
	<i>Roystonea oleraceae</i>		Tree	
Poaceae	<i>Bambusa vulgaris</i>	Bamboo	Tree	Introd
	<i>Coix lacryma-jobi</i>	Job's Tears	Herb	
	<i>Isachne disperma</i>		Herb	
Ponterderiaceae	<i>Eichornia crassipes</i>	Water Hyacinth	Herb	Introd
Smilacaceae	<i>Smilax guianensis</i>		Vine	
	<i>Smilax oblongata</i>		Vine	
Zingiberaceae	<i>Costus scaber</i>		Herb	
	<i>Hedychium coronarium</i>		Herb	Cult/Introd
	<i>Zingiber officinale</i>	Ginger	Herb	Cult/Introd

Notes:

? = indicates record may be in question

Cult = Cultivated

ID = Identity/identification

Introd = Introduced

APPENDIX 3

Terrestrial Invertebrates of Grand Etang and Annandale Forest Reserves

SPECIES	STATUS
Insects: INSECTA	
Dameselflies: ZYGOPTERA	
Coenagrionidae	
Argia concinna	Regional Endemic
Argia telesfordi	Endemic?
Ischnura ramburii	
Dragonflies: ANISOPTERA	
Libellulidae	
Brachymesia furcated	
Brechmorhoga (praecox) grenadensis	Endemic? Rare
Dythemis sterilis	
Erythrodiplax fusca	
Micrathyria aequalis	
Stick Insects: PHASMIDA	
Phasmatidae	
Diapherodes gigantea	
Mayflies: EPHEMEROPTERA	
Leptophlebiidae	
Farrodesgrenadae	Endemic
Beetles: COLEOPTERA	
Scarabaeidae	
Canthon perseverans	
Carabidae	
Pseudaptinus thaxteri	
Dynastidae	
Strategus tarquinius	

SPECIES	STATUS
Butterflies & Moths: LEPIDOPTERA	
Hesperiidae	
Chioides vintra	
Pieridae	
Euremavenus taemanona	
Lycaenidae	
Strymon rufo-fusca	
Electrostry monangerona	
Heliconiidae	
Dryas iulia framptoni	
Dione junio junio	
Agraulis vanillae vanilla	
Bees & Wasps: HYMENOPTERA	
Eulophinae	
Miotropis histrionica	
Shrimps, Crabs, Crayfish & Lobsters: DECAPODA	
Atya innocuous	
Jonga serrei	
Macrobrachium faustinum	
Macrobrachium heterochirus	
Macrobrachium jelskii	
Macrobrachium sp.	
Micratya poeyi	
Potimirim glabra	
Potimirim sp.	
Xiphocaris elongata	
Terrestrial Snails and Slugs: STYLOMMATOPHORA	
Helicinidae	
Helicina keatei	Endemic
Helicina occidentalis	
Nertina punctulata	

SPECIES	STATUS
Neocy clotidae	
Aperostoma grenadense	Endemic
Thiaridae	
Melanoides tuberculata	
Planorbidae	
Drepanotrema anatinum	
Physidae	
Aplexa marmorata	
Veronicellidae	
Veronicella sp.	Introduced
Succineidae	
Succinea approximans	
Orthalicidae	
Bulimulus wiebesi	Endemic
Drymaeus binominis	
Plekocheilusglaber grenadensis	Endemic
Subulinidae	
Leptinaria lamellata	
Opea soctogyrum	
Subulina octona	
Streptaxidae	
Streptosteles musaecola	
Scolodontidae	
Systrophia thomasi	
Pleurodontidae	
Pleurodonte perplexa	

APPENDIX 4

Terrestrial Mammals of Grand Etang and Annandale Forest Reserves

No.	ORDER	FAMILY & SUB-FAMILY	COMMON NAME	SPECIES	CONSERVATION STATUS*
	CINGULATA - Armadillos				
		Trichechidae			
1		Dasyponidae	Nine-banded Armadillo	<i>Dasypus novemcinctus</i>	Possibly introduced. Common to locally common
	CHIROPTERA - Bats				
		Noctilionidae			
2			Greater Bulldog Bat	<i>Noctilio leporinus mastivus</i>	Widespread, common, though often overlooked
		Vespertilionidae			
		Subfamily: Myotinae			
3			Black Myotis	<i>Myotis nigricans nigricans</i>	Very rare
		Emballonuridae			
4			Lesser Doglike Bat	<i>Peropteryx macrotisphaea</i>	Rare
		Mormoopidae			
5			Naked-backed Bat	<i>Pteronotus davyi davyi</i>	Extremely rare, if not extinct
		Phyllostomidae			
		Subfamily: Phyllostominae			
6			Little Big-eared Bat	<i>Micronycteris megalotis</i>	Rare. Possibly an accidental vagrant or extinct
		Molossidae			
7		Subfamily: Molossinae	Pallas's Mastiff Bat	<i>Molossus molossus molossus</i>	Widespread and very common
		Subfamily: Glossophaginae			
8			Geoffroy's Tailless Bat	<i>Anoura geoffroyi geoffroyi</i>	Widespread but uncommon to locally rare
9			Miller's Long-tongued Bat	<i>Glossophaga longirostris</i>	Widespread and common
		Subfamily: Carollinae			
10			Seba's Short-tailed Bat	<i>Carollia perspicillata perspicillata</i>	Very rare. Possibly an accidental or occasional vagrant or extinct
		Subfamily: Stenodermatinae			
11			Jamaican fruit	<i>Artibeus jamaicensis</i>	Endemic sub-species;

No.	ORDER	FAMILY & SUB-FAMILY	COMMON NAME	SPECIES	CONSERVATION STATUS*
			bat	<i>grenadensis</i>	widespread and Common
12			Greater Fruit-eating Bat	<i>Artibeus lituratus palmarum</i>	Locally Common
13			Bogota Fruit-eating Bat	<i>Artibeus bogatensis</i>	Rare
14			Flat-faced Fruit-eating Bat	<i>Artibeus planirostris</i>	Uncommon to rare
15			Yellow-shouldered Bat	<i>Sturnira lilium serotinus</i>	Uncommon to rare
	DIDELPHIMORPHIA – Opossums & Allies				
		Didelphidae – American Opossums			
16		Sub-family: Didelphinae	Robinson's Mouse Opossum	<i>Marmosa robinsoni</i>	Possibly introduced. Uncommon to rare
			Common Opossum or Manicou	<i>Didelphis marsupialisinsularis</i>	Locally common. Hunted for food
	CARNIVORA - Carnivores				
		Herpestidae - Mongooses			
17		Sub-family: Herpestinae	Small Indian Mongoose	<i>Herpestes javanicus</i>	Introduced. Widespread and locally common
		Felidae - Cats			
18		Sub-family: Felinae	Domestic Cat	<i>Feliscatus</i>	Introduced. Domesticated. Widespread and sporadic in some areas
	RODENTIA - Rodents				
		Dasyproctidae - Agoutis			
19		Sub-family: Dasyproctinae	Red-rumped Agouti	<i>Dasyproctale porinaleporina</i>	Reportedly introduced. Now believed extinct
		Muridae – Murine Rodents			
20		Sub-family: Murinae	Black Rat	<i>Rattus rattus</i>	Introduced. Widespread
21			Brown Rat	<i>Rattus norvegicus</i>	Widespread.
22			House Mouse	<i>Mus musculus</i>	Widespread. Most common around human habitations
	PRIMATES - Primates				
		Cecopithacidae – Old World Monkeys			
23		Sub-family: Cercopithecinae	Wolf's Mona Monkey	<i>Cercopithecus wolffi</i>	Introduced. Widespread but locally common

* Conservation Status refers to the local status of the species and not to the global categorisation.

APPENDIX 5

Amphibians and Reptiles of Grand Etang and Annandale Forest Reserves

NO.	ORDER	FAMILY	COMMON NAME	SCIENTIFIC NAME	CONSERVATION STATUS
1	AMPHIBIA	Bufonidae	Marine Toad	<i>Rhinella marinus</i>	Introduced; locally common to common
2		Eleutherodactylidae	Lesser Antillean Frog	<i>Eleutherodactylus johnstonei</i>	Introduced; common
3		Leptodactylidae	Windward Islands Ditch Frog	<i>Leptodactylus validus</i>	Locally common
4			Giant Ditch Frog	<i>Leptodactylus fallax</i>	Extinct
5		Strabomantidae	Grenada Ditch Frog	<i>Pristimantis euphronides</i>	Endemic; common to locally common
6	REPTILIA	Gekkonidae	Tropical House Gecko	<i>Hemidactylus mabouia</i>	Introduced
7		Iguanidae	Grenada Bush Anole	<i>Anolis aeneus</i>	Common
8			Grenada Tree Anole	<i>Anolis richardi</i>	Common
9			Green Iguana	<i>Iguana iguana</i>	Rare and occasional
10		Phyllodactylidae	Thick-tailed Gecko	<i>Thecadactylus rapicauda</i>	Unknown
11		Boidae	Grenada Bank Boa	<i>Corallus grenadensis</i>	Endemic; locally common to sometimes rare
12		Colubridae	Windward Tree Racer	<i>Mastigodryas bruesi</i>	Regional endemic; rare
13			Neuwied's False Boa	<i>Pseudoboa newwiedi</i>	Reportedly extinct
14			Black-headed Snake	<i>Tantilla melanocephala</i>	Introduced
15		Dipsadidae	Windward Clelia	<i>Clelia clelia</i>	Uncommon to rare
16		Typhlopidae	Grenada Blindsnake	<i>Typhlops tasymicris</i>	Endemic; locally common to rare

APPENDIX 6

Assessment of Game Animal Populations

The following is a review of a methodology for assessing game animal populations and recommendations for the management of game animals of conservation concern.

First Step

The first priority would be for Forestry to consult an expert in the two taxa to determine the taxonomic status of the two opossums and the Armadillo on the island. Many reports, mammologists, agencies and conservationists have generally shared a strongly held belief that all of these species are recently introduced and are in fact invasive, posing serious threats to native wildlife and the ecological integrity of Grenada.

Though hunting of the Armadillo and Manicou is a very important social, cultural, historical, economic and dietary part of Grenada's identity, international agencies and experts would find it difficult to support any effort to conserve and promote the sustainability of these populations, and would likely express strong reservations regarding help, advice on, or funding for any such effort.

It is therefore imperative that the taxonomy of the species be established before any long-term effort to manage and conserve them is put in place.

Step Two

In order for Forestry to understand the issues affecting the species and the issues surrounding them, there would have to be a broader assessment and survey of the wild species of animals, plants, ecological framework, human activities and conditions within and adjacent to the Reserves. This effort needs to be tied to broader biodiversity and environmental issues, and to an updating of ecological baseline data for the Reserves. The Armadillo and the Opossum cannot be separated from their environment, and it is this environment that allows them to survive. Therefore, understanding the underlying eco-framework and associated environmental and cultural issues would help ensure the most effective approach to management and conservation.

Step Three

Carefully develop objectives for this undertaking and prepare a proposal, including a budget to cover the costs of an expert's time and involvement, training and capacity building activities, equipment purchases, and the mapping and reporting of findings. The proposed methodology should be developed with the expert to allow for an effective project to be developed.

Step Four

There are many approaches to conducting population surveys and assessments. The exact methods employed will depend on many factors, including the defined objectives, expected outcomes, the level of competency of the field team, the landscape and environment, the species and/or target populations, the season/time of year and weather conditions and more. One expert recommended that:

Forestry should bring in a specialist for a week or two to work with the staff to design a method tailored to suit their needs and budget, and to give some relevant training in data collection, storage and analysis.

It is unlikely that Forestry really needs or would have the resources to implement a *census* (total count of the population size) of either species, but it would be best if they develop a rapid measure of relative abundance in order to compare different areas and determine whether their numbers are stable, rising or falling.

Manicou/mannikou are pretty easy to catch and see, so common ways to monitor population trends are to use a standard number of live traps (record the number caught per trap-night) or walk fixed transects at night and count the number seen.

For some tips on rapid opossum survey methods, the expert recommended Forestry consult the Mammals of Saint Lucia document prepared after a two year effort to assess the biodiversity and ecological baseline of that island. For information, see http://www.bananatrusterslu.com/doccentre/National_Forest_Demarcation/Mammals%20of%20St%20Lucia%20technical%20report.pdf (*note: this not a monitoring programme*).

A similar approach is recommended for Armadillos.

NB: Note that experts consulted strongly feel that monitoring of the species should only be implemented if the Department has the long-term capacity to develop, implement and maintain the effort. The expert suggests that most monitoring wildlife programmes are abandoned after only 2-3 cycles or end up being modified by people who do not understand the importance of maintaining the same approach and methodology. Monitoring programmes are not to be recommended unless the Forestry Department confirms it wants and needs them and will commit to them for the long term. Monitoring programmes have more chance of surviving if they take very little time to implement or interpret, and the implementers are directly involved in designing them and obtaining regular feedback on their findings.

APPENDIX 7

Concept Proposal and Cost Estimate for an Ecological Assessment of the Grand Etang and Annandale Forest Reserves

Background

During consultations with the Grenada Forestry Department, the issue of priorities for long-term ecological management of the Reserves' resources was of particular concern to the staff. For the Forest Reserves to be managed effectively and sustainably, it is critical to develop a comprehensive assessment of the ecological resources and issues. With this in mind, IRF has included a brief proposal summary and outline, provided below, for such an effort.

Justification

The species, habitats, ecological processes, services and issues of Grand Etang and Annandale Forest Reserves are quite extensive and complex. OECS-OPAAL's 2005-2011 efforts to develop these Reserves as protected areas and demonstration models for other similar areas of Grenada is now at an end. As mentioned elsewhere in this report, during the time period proved specifically for IRF's baseline environmental studies in 2011, it proved impossible to conduct the kind of comprehensive and detailed survey and assessment of the Reserves' assets and ecological conditions, although we have argued herein that this is needed for the effective management and conservation of the Forestry Reserves and National Park.

The Foundation's week of field survey of the two Reserves earlier this year revealed a great deal, but it was not nearly enough. A more representative and comprehensive assessment of the biodiversity of the Reserves requires going beyond the confines of the human-imposed boundaries and limits in order to assess those features and assets that affect or impact the Forest Reserves.

Grand Etang and Annandale Forest Reserves are but smaller fragments of a greater Grenada landscape. For the two Reserves to have long-lasting impact and successfully render essential eco-services to the country, a concerted effort to better understand the sites' complex ecological facets is needed, particularly so as to provide best management practices for the resource base and stakeholder communities. The reality of the future of the two sites is that Grand Etang and Annandale cannot continue to be maintained as mere circumscribed fragments, cut off from the rest of a vibrant and interconnected whole. In order to understand and know these areas, researchers, planners and managers will have to go beyond the immediate boundaries of the protected areas.

Despite the fact the natural underlying structure of the Reserves are fundamental to how they function—to how they appear and the natural services that they provide—there is a

general lack of appreciation and understanding for this underlying framework. This attitude not only undermines Grenada's ability to effectively protect and manage the resources of the Forest Reserves, but it also undermines the development of Grenada.

If Grenadians do not work toward achieving a holistic understanding of the component parts and functions of the Grand Etang and Annandale Reserves, they will effectively constrain themselves and limit the eventual procurement of important knowledge to be gained from science, research, careful study and observation, all of which can shed new light on the myriad of unknowns of these two remarkable Grenadian treasures.

Objectives

1. To establish up-to-date baselines for the flora, fauna, ecosystems and conditions of Grand Etang, Annandale and surrounding areas;
2. To determine and understand the ecological framework of both Reserves;
3. To develop the local science, research and management capacities of relevant government agencies, personnel and other key stakeholders; and
4. As a result of these outcomes, to develop best management practices (BMP) for the sustainable management of the Reserves.

Duration

24 to 30 months

Areas of Focus

There are seven broad areas of focus. These are:

1. Field Survey and Assessments

Survey of:

- Mammals, including bats and game species
- Reptiles and amphibians
- Invertebrates, including aquatics
- Vascular plants
- Non-vascular plants
- Vegetation communities
- Assessment of rare, endemic, threatened and endangered species of flora and fauna

2. Literature Review, Research and Archive Development

- Research and review of all available reports, papers, documents and local information: published and otherwise and compile into a report; and
- Sourcing all available reports, data, papers, documents and information on specimens from around the world and locally and creating a local repository.

3. Reporting

A final report for all areas of focus prepared, with sub-reports written by each focus team.

4. GIS Mapping and Capacity Building

All resources and issues are to be mapped while, simultaneously, there will be a training and capacity-building component built in:

- Aerial imagery/map reading and interpretation;
- GPS applications and use; and
- Creating local and regional GIS linkages and networks with key stakeholders and interests.

5. Training in Plant Identification and Herbarium Techniques

- Building local capacity in plant identifications
- Building local capacity in herbarium techniques
- Creating plant conservation linkages to regional initiatives

6. Training in Scientific Writing and Publications

- Increasing local capacity for writing scientific papers, publishing them and to encourage local research and innovation. This would be done at a local seminar conducted by experts.

7. Creating Databases

- Creating effective databases for storing and retrieving field data and for managing relevant information.

Approach

For Project Management:

- A project coordinator (fulltime)
- A local co-coordinator
- A local liaison person and Information Officer to engage stakeholders and help build awareness

For Expert Survey Team:

- Senior mammologist, plus 2 junior experts
- Senior herpetologist and one junior herpetologist
- Senior entomologist and one junior
- Two regional/international vascular plant and vegetation experts, plus two field assistants
- One non-vascular plants expert

For GIS Mapping Team:

- One GIS expert

For Database Team:

- One database creator and trainer working with the key government agency and local technology school/institute.

Training in plant identification should be done by the plant and vegetation team. Herbarium training could be done by the Herbarium at the University of the West Indies, St. Augustine.

Literature review and research will be done by the project coordinator. Archiving will be done as a cooperative approach led by the Coordinator with support from the local liaison, each team member and the local library and relevant government agencies.

Field Surveys will be done twice in the first year and once in the final year. For the first year, the team will be made up of international and local members, and in the second year, it will consist of local members except where it is necessary to include an international expert.

The project will hold an initial introductory workshop and a final wrap up workshop.

Each team area of focus would be integrated with local counterparts who will be trained in the respective field and who would be expected to participate fully in the effort, including writing regular reports.

The project is not only to increase information on the ecological resources of the Reserves, but also to increase local awareness and build capacity. While working with key stakeholders/staff in Forestry and other agencies, the project will also encourage young scientists by creating short-term internships for local students.

For each year, the project will select a qualified student to intern with the project. Each intern must produce a comprehensive report at the end of tenure. Each student will be provided a reasonable stipend to cover their costs and as an incentive.

The results from the project will be made widely available. To this end, these will be available on a project website.

Cost Estimate

Estimated costs are approximately EC\$650,000, over a 30-month period.

APPENDIX 8

Concept Proposal and Cost Estimate for a Watershed Assessment of Grand Etang and Annandale Forest Reserves

Draft Proposal Summary for a Watershed Assessment of the Grand Etang and Annandale Forest Reserves, Grenada.

Objectives

1. To establish up-to-date baselines for the watershed conditions of Grand Etang, Annandale and surrounding areas;
2. To determine and understand the hydrology, soils, geology, erosion and sediment load conditions and issues both Reserves;
3. To develop the local science, research and management capacities of relevant government agencies, personnel and other key stakeholders;
4. Develop update soil, geology, climate and weather maps for both Reserves; and
5. As a result of these outcomes, to develop best management practices (BMP) for the sustainable management of the Reserves.

Duration

24 to 30 months

Areas of Focus

There are five broad areas of focus. These are:

1. Field Survey and Assessments

Survey of:

- Soils: updating and standardising the soil classification system for the Reserves;
- Geology: updating and standardizing the geology classification system for the Reserves;
- Sedimentation and erosion issues and vulnerabilities, including landslides;
- Hydrology and water resources;
- Climate and weather, including the potential effects of climate change;
- Ridge to Reef issues: understanding ecological issues and interactions of the Reserves and coastal areas;
- Implementation of best management practices
- Development of appropriate GIS framework for research and management, including capacity building.

2. Literature Review, Research and Archive Development

- Research and review of all available reports, papers, documents and local information: published and otherwise and compile into a report; and
- Sourcing all available reports, data, papers, documents and information on specimens from around the world and locally and creating a local repository

3. Reporting

A final report for all areas of focus prepared, with sub-reports written by each focus team.

4. GIS Mapping and Capacity Building

All resources and issues are to be mapped while simultaneously, there will be training and capacity building component built in:

- Aerial imagery/map reading and interpretation;
- GPS framework, applications and use; and
- Creating local and regional GIS linkages and networks with key stakeholders and interests.

5. Training in GIS Application, Frameworks and Uses Techniques

- Building local capacity in GIS framework and applications
- Creating local and regional GIS linkages and networks with key stakeholders and interests.

Approach

For Project Management:

- Project coordinator
- Local co-coordinator possibly seconded from the relevant government agency
- Local liaison person and Information Officer to engage stakeholders and help build awareness.

For Expert Survey Team:

- Hydrologist, plus an assistant
- Geomorphologist
- Soils expert

For GIS Mapping Team:

- One GIS expert

Field Surveys will be done twice in the first year and once in the final year. For the first year, the team will be made up of international and local members, and in the second year, it will consist of local members except where it is necessary to include an international expert.

Training and Capacity Building

The project will hold an initial introductory workshop and a final wrap up workshop at the end.

Each team area of focus would be integrated with local counterparts who will be trained in the respective field, and who would be expected to participate fully in the effort, including writing regular reports.

The results from the project will be made widely available. To this end, these will be available on a project website.

Cost Estimate

Estimated costs are approximately EC\$350,000, over a 30-month period

PART III

SOCIO-ECONOMIC BASELINE STUDY

III/1. The Baseline Socio-economic Study

The Annandale and Grand Etang Forest Reserves are surrounded by the communities of Vendome, New Hampshire and Constantine. These communities depend on the watershed protection services provided by the Reserves and, to varying degrees, they also depend on the Reserves for their livelihoods. Over the years, the Reserves have provided residents with materials for shelter, crafts, food and fuel. As well, many have found employment in tourism-related activities at the Annandale Falls, one of Grenada's main tourist attractions.

The Reserves have been used for recreation as many trails have been built through the protected areas over the years, although many have yet to be restored following Hurricane Ivan. There are also picnic facilities at the Grand Etang Lake, viewpoints and a visitor centre complex that offers food and beverage and vendor concessions (Turner, 2007).

These concessions, along with the Grand Etang Visitor Complex, are presently the centre of economic activity and have been used by the tour operators since the 1980s. There has been a gradual shift towards conservation activities because of widespread pollution and watershed degradation caused by the production of agricultural crops such as bananas, cocoa, citrus fruits and nutmeg in the Annandale Forest Reserve.

The Reserves are now embarking on a new phase. As such, there is a need for a more effective framework to manage protected areas in ways that successfully conserve biodiversity and maintain ecosystem functions while at the same time achieving more substantial participation of communities in the management of these resources and in the long-term economic benefits derived from the resources.

Part III of the IRF baseline study presents the socio-economic findings from our review of secondary information and data as well as surveys of the local communities by the IRF team. It presents the viewpoints of Government and community representatives on the designation of the Reserves as a protected area and on the restrictions that might be associated with such a designation. The team also explored community opinions on how economic activity can be increased for the benefit of residents and how to attain and sustain community participation in the process.

III/1.1. Introduction and Methodology

In undertaking the socio-economic study, the IRF team employed a process of research, consultations and field interviews in order to assess the accuracy of existing socio-economic data and information on issues and conditions relevant to the PA site and its management. Primary data sources from Government and other local organisations provided essential information on the social and economic situation; secondary information was used to provide more insight into the relationship of the biodiversity conservation proposals incorporated in the OPAAL Project with the three legs of the sustainable development triad (*i.e.*, social, economic and environmental) in the GE&ARF National Park site itself. Important secondary documents used included:

The Grand Etang and Annandale Forest Reserves Management Plan (Turner, 2007);
Findings and outputs obtained from the *OPAAL Livelihoods Opportunity Assessments* (Parsram, 2007);
Outputs of the *Protected Area Systems study for Grenada*;
OPAAL Protected Areas Training Needs Assessment Country Report (Parsram, 2007);
Grenada Forestry and National Parks Grand Etang and Annandale OPAAL Livelihood Project Proposal.

The IRF Team then developed a plan of action which outlined an approach that the remainder of the project would take. Given that a considerable amount of study had already been completed for this OPAAL demonstration site—particularly in areas such as livelihood opportunities, assessment and development, public attitudes to Protected Areas, and existing and required capacity for the management of such areas—the IRF approach concentrated on:

- Reviewing relevant reports and documents relating to the demonstration site and the surrounding communities as well as national plans, directions and priorities at the socio-economic level, and
- Consulting with local stakeholders at several levels of interaction with the Reserves to verify and assess previous reports and to detect any gaps or inconsistencies and address these.

The plan of action was then submitted to the members of the National Implementation Coordination Entity (NICE) for their comments and approval.

A visit was made to Grenada from January 24 to 30, 2011. The IRF team met with the NICE and a wide cross-section of stakeholders and community representatives. Recommendations from the NICE, along with the knowledge of the IRF's local liaison, Mr. Tyrone Buckmire (director of the Grenada Fund for Conservation), were relied upon to identify Government agencies, NGOs, interest groups, commercial interests, and

communities with involvement or stakeholder interests in the proposed PA or in adjacent areas likely to be affected by the PA's establishment.

The purpose of the one-on-one stakeholder engagements was to confirm information collected during the desk review process. In addition, the process helped to facilitate cross-sectoral dialogue. The team also conducted an informal assessment of local stakeholder capacity and willingness to participate in managing the Reserves as Protected Areas and their willingness to develop entrepreneurial activities associated with the development and operation of the PAs.

III/1.2. Basic Socio-Economic Data

III/1.2.1. Population Groups Most Affected by Proposed Protected Area

The Annandale and Grand Etang Forest Reserves are surrounded by many communities that span the parishes of St. George's and St. Andrew's. Previous assessments have not consistently reported on the same communities, which lessens our ability to do comparisons across reports smoothly. Espeut (2006) included the following enumeration districts in what he termed the "Annandale Area":

- Mango,
- Willis,
- New Hampshire,
- Vendome,
- Granton,
- Constantine, and
- Annandale.

Lewis and Marquez-Sylvester in their 2010 sample survey used:

- New Hampshire,
- Vendome,
- Adelphi,
- Spring Garden,
- Constantine and
- Annandale.

As the last census was conducted ten years ago, Lewis and Marquez-Sylvester's research findings offer valuable insight into changes to the demographic landscape since 2001. The following tables provide some information on how the population is aggregated by age and sex.

Table 12. Age-Sex Distribution in the Annandale Area and Island of Grenada, 2001

	ANNANDALE AREA			GRENADA		
	Male	Female	Total	Male	Female	Total
Under 15 years	552	519	1,071 (33.8%)	16,900	16,572	33,472 (32.5%)
15-64 years	901	898	1,799 (56.9%)	30,393	29,800	60,193 (58.4%)
65+ years	103	191	294 (9.3%)	4,085	5,393	9,478 (9.2%)
TOTAL (N=)	1,556	1,608	3,164	51,378	51,765	103,143

Source: Espeut, 2006.

Table 13. Gender Composition of Selected Grenada Communities (note that this study only sampled 10% of the population).

Community	Males	Females	Total
Vendomme	28	25	53
New Hampshire	67	68	135
Annandale	24	29	53
Adelphi/Spring Garden	7	8	15
Constantine	21	20	41
TOTALS	147	150	297

Source: Lewis and Marquez-Sylvester, 2010.

The age and sex distribution in the communities surrounding the Reserves are almost identical to that of Grenada, which implies that national policies and programmes should not be impinged by demographic variances when being implemented in the area. It is also interesting to note that the figures show a 6.13% drop in the overall population from 2001 to 2010. This variation, however, may be due to inconsistencies in the communities used by both studies or by other contributing factors such as hurricane displacements or counting errors.

Figure 6 shows that 55% of the persons surveyed were under retirement age, of which 20% were under 30 years of age. This could have a positive influence on efforts to train or retrain residents so that they can take advantage of new livelihood opportunities and the resources of the Reserves.

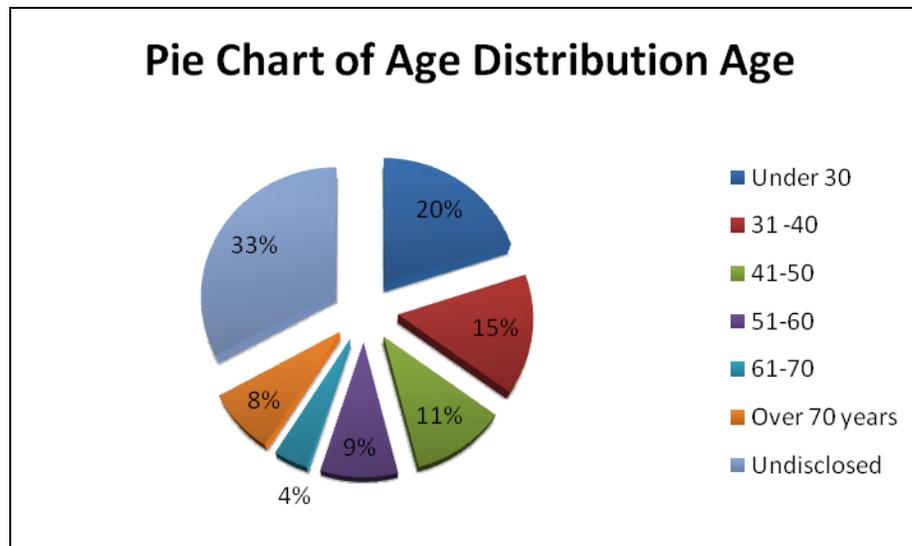


Figure 6.

Age composition of Grenada communities surveyed by Lewis and Marquez-Sylvester (2010).

III/1.2.2. National Development Trends and Impacts on Livelihood Goals Implementation

The Government of Grenada's 2011 Budget Statement provides insight into the national development goals of Grenada. It states a desire to:

...transform the Grenadian economy ... by moving from a two pillar economy consisting of tourism and agriculture to a five pillar economy that is more diversified and resilient to external shocks and capable of generating new and higher income opportunities for all our people"

It goes on to identify the five sectors which, in the Government's view, have the greatest potential to contribute to the economic transformation of the nation (the so-called "transformational sectors"). These sectors are:

1. Health, Education and Wellness Services

The GE&AFR Management Plan does not speak specifically to health and wellness services, but national parks are renowned for the health and wellness advantages they offer. Research should be conducted into the specific ways in which the GE&AR National Park can contribute to attaining this national goal. For instance; there are many plant species within the GE&AFR that locals have relied upon for generations for their health benefits. National resources could be channelled into better understanding of what medical resources lay within the National Park and its environs and how they can be sustainably exploited by local communities.

2. Tourism and Hospitality Services

The budget allocated EC\$28.9 million for this sector, which represents a strong drive to attract more visitors to the island. It also emphasises the development of heritage tourism through festivals and village branding. If these are successfully implemented, they could play an important role in supporting the National Park through collection of increased park fees and use of park amenities as well as a steadier stream of customers for community businesses.

3. Agri-business

The budget identified agribusiness as a *“bright spot in the Grenadian economy”* and outlined its plan for improving the sector further; these included increasing planting materials to increase food production and exports; increasing production in root crops, fruit orchards, supporting agro-processing, institutional strengthening, and conversion of Government estates into more commercial and productive farms, among others. Lewis and Marquez-Sylvester’s 2010 Livelihoods Feasibility Study identified agro-forestry as an appropriate livelihood opportunity; however, Espeut’s assessment pointed out that not all agricultural activities are appropriate for the GE&AFR, cultivating root crops for example. Therefore, it is important that the entity that will manage the National Park is able to maintain a close and collaborative relationship with the Ministry of Agriculture and be proactive in supporting appropriate agricultural activities that can take place within the boundaries of the Protected Area and its environs.

4. Energy Development

With the escalating price of oil, the Government is convinced that the only solution is to transition to a low-carbon economy, perhaps through the exploitation of geothermal energy resources. While pursuing renewable energy sources is a worthy and appropriate goal for Grenada, it is possible that such resources might be identified within the boundaries of the National Park. Once again, a proactive approach is recommended. The GE&AFR Management Plan clearly identifies the approved activities and the zones within which they should take place. All stakeholders within this sector need to be made aware of these restrictions and educated on the goals and objectives for establishing the National Park.

5. Information Communication Technology (ICT)

The Budget Statement also declared that *“generating jobs through investing in ICT infrastructure and e-Government can create a platform for economic development ... [and] provide a vehicle for knowledge transfer and act as a catalyst for entrepreneurial activities.”* The transition to an ICT-based economy usually means less stress on natural resources. In fact, if communities were to receive training and facilities, the Internet could provide a powerful tool for the promotion and development of their businesses.

An overarching goal of all of Government's economic goals is its **Growth and Poverty Reduction Strategy**. Growth has been strongly associated with job creation through creating a business climate in which firms and entrepreneurs feel that they have enough of a claim on their assets to invest heavily in them. The intention of this Strategy is to *"identify the projects and business opportunities that have the potential to directly and materially contribute to sustained economic growth"* (Government of Grenada, 2011 Budget Statement). This goal is similar to that of the National Park, and every effort should be made to communicate the priority areas highlighted in Park development documents and other livelihood studies to the Government and to form working partnerships to ensure that they are prominently incorporated within the Government's Growth and Poverty Reduction Strategy.

III/1.3 Stakeholder Analysis

The IRF team also investigated some of the actions most likely required for promotion of the livelihoods to benefit from the GE&AFR National Park. This "stakeholder analysis" is more illustrative than definitive, but it does provide guidance about the level of effort and the level of institutional infrastructure that Stakeholder Analysis, as a management technique, requires.

In multi-objective, multi-stakeholder systems, a definition that characterises most public sector programmes, "stakeholder analysis" is more complex than in profit-dominated private sector programmes or products. Based on the experiences of members of the IRF team, we feel there is a real possibility that such documentary complexity is a major disincentive for the kind of open and transparent, innovative, and locally-rooted management actions needed to make protected areas work, especially in dynamic, resource-constrained environments with high resource and input costs.

In Table 14, we have adapted one particular stakeholder analysis model endorsed by the Sloan School of Business (see URL below) to key major "livelihood activities" related to priorities surveyed by Lewis and Marquez-Sylvester (2010) in Grenada.

Table 14. Stakeholder Analysis.

Livelihood Activity	Current Stakeholder Actions											Commitment				Analysis							
	Stakeholder			Current Support Rank 1 2 3	Change Needed					Reasons for Possible Resistance					Main Role/ Expected Tasks		Action Required		Presently Capable Y/N	Benefit			Rank 1 2 3
	Name	Type			Op	En	Sp	Co	Rs	Ev	FR	SR	TC	TA	DB	Let	Help	Make		F.S	E.S	S.S	
Trail Development	Dpt. Forestry & NP		√	1	.		.	.	.		.	.			ID and avoid critical areas; monitor LT impacts; trails' maintenance.		√		N			2	
	Ministry of Tourism		√	2		.	.	.	.		.	.			Design, signage, promotion		√		Y	√		2	
	Ministry of Works		√	1		.	.	.	.		.	.			Design/eng. and heavy equipment		√		Y	√		3	
	Community Associations			√	1	.	.	.	.	.		.			Routing and contributed resources (labour and materials, e.g., gravel)		√		Y	√	√	2	
Hiking & Trail Guiding	Dpt. Forestry & NP		√	1	.			.	.	.					Certification of guides; Maintenance of trails. Monitoring of park use and resolving conflicting uses			√	Y		√	1	
	Ministry of Tourism		√	1		.		.	.						Tabulate & allocate cruise visitors to forest or volcano trails; guide evaluation w/ NPs			√	Y	√	√	3	
	Operators	√		2					.			.			Dissemination of natural heritage & cultural information specific to tours			√	Y	√		1	
	Community Associations	√		2	.					.					Monitor local impacts of tourists and tour guide behaviours			√	N		√	√	2
	Guides & Guide Associations	√		√	1	.	.	.		.					Marketing local drinks in major visitor magazines			√	Y	√		√	1
Agro-processing forestry, horticulture	Dpt. of Health		√	?				.	.	.	.	.	.		Identification of other medicinal plants	√			Y		√	√	2
	Dept Forestry & NPs		√	2	.	.	.			.	.	.			Monitoring harvesting from Reserves; flagging endangered species sites.		√		N				2
	Ministry of Education		√	2	.					.	.	.			Introduction of agro-processing in non-formal education curriculum		√		?		√	√	2
	Operators	√		1	.			.	.	.	.	.			Training in preservation and storage of teas and other health juices			√	Y	√	√	√	3
	Product Consignees	√		√	1	.	.	.		.	.	.			Training in stock mgmt, financing			√	Y	√		√	2
Art and Craft	Ministry of Education		√	1				.			.				Facilitate extracurricular craft lessons			√	Y		√	√	1
	Ministry of Tourism		√	2		.	.		.						Promotion of local authentic craft through development of icon	√			Y	√	√	√	2
	Dpt. of Trade		√	1		.		.				.			Creation of logo identifying local handmade Kittitian craft		√		Y	√		√	2
	Operators	√		1	.	.	.	.				.			Pursue training in craft making and sales			√	Y	√		√	1

LEGEND for Table 14.

ITEM	Code	Code Meaning
Stakeholder Type	Pv Pc NGO	Private non-resident or resident Public Non Government Organization or Community Based Organization
Ranks	1 2 3	Low Medium High
Change Needed	Op Fn Sp Co Rs Ev	Operational: Way in which activity is pursued or carried out Financial: Investment, Funding, Capital Input Support: Overall support given to activity, including legislation, regulation & enforcement Coordination: Liaisons and interactions between stakeholders and Livelihood operators Research: Data Collection, Statistical Collation, Database, Environmental : Actions taken for sustainability and protection of ecology
Possible Resistance (PR) (Lack of...)	FR SR TC TA DB	Financial Resources Staffing Requirements Technical Capacity Time Availability Direct Benefits
Action Required	Let Help Make	Allow recommendation to happen with little or no further contribution Provide assistance to ensure recommendation happens Take lead and full responsibility for ensuring recommendations happen
Benefit	F.S. E.S. S.S.	Financial Sustainability Environmental Sustainability Social Sustainability
Presently Capable	Y N	Yes No

Adapted from: <http://sloanreview.mit.edu/the-magazine/files/2008/11/3442-ex8-lo.png>

III/1.4. Special Population Groups

III/1.4.1. Home Ownership

Espeut (2006) comments on the high rate of home ownership in Grenada (in comparison with other Caribbean islands), but this is a cultural rather than economic issue. Regardless, both the Reserve areas and the national averages show similar high rates, indistinguishable given the small numbers in the Annandale area. Home ownership is sometimes an indicator of entrepreneurial behaviour, but studies of this factor are not known to have been conducted in Grenada.

**Table 15. Ownership of House and Land on which House Is Built
Annandale Area and Grenada, 2001**

	ANNANDALE AREA		GRENADA		
	House	House Spot	House	House Spot	
Owned	531 (88.1%)	487 (80.8%)	21,255 (81.8%)	1	8,787 (72.3%)
Rented	29 (4.8%)	54 (9.0%)	2,907 (11.3%)	3,249 (12.5%)	
Leased	-	6 (1.0%)	33 (0.1%)	408 .	
Rent-Free	.	7 (1.2%)	1,268 (4.9%)	11	23 4.3%
Squatter	1 (0.2%)	7(1.2%)	110 (0.4%)	603 (2.3%)	
Other	10 (1.7%)	42 (7.0%)	416 (1.6%)	181	3 (7.0%)
TOTAL	603	603	25,989	25,989	

Source: Espeut, 2006.

III/1.4.2. Employment

Table 16 and Figure 7 show that in 2001 the unemployment rate in the Annandale area was slightly higher than that of Grenada overall. However, the 2010 figures paint a very different picture as they imply a significant rise in unemployment. More research is needed to verify their accuracy and to ascertain the reasons for it, and the PA management team will need to take this into particular consideration when developing employment opportunities. These figures also prompt the question of how persons are sustaining themselves and their families and may indicate that closer observation and scrutiny need to be placed on the level of subsistence farming and hunting within the Reserves.

Another telling statistic is the difference in labour force participation between males and females, with 74.7% of men participating versus 52.4% of women. The unemployment rate is also higher for women. This suggests that women may be a significant resource for increasing household economic returns, which seems to be validated by the high rate of female beneficiaries in OPAAL project activities, especially tour guiding, arts and crafts, and agro-processing businesses (*OPAAL statement, 30 May 2011*).

**Table 16.
Labour Force Data: Persons 15 Years and Over, Annandale Area and Grenada, 2001.**

	ANNANDALE AREA			GRENADA		
	Male	Female	Total	Male	Female	Total
Employed	662	490	1,152	22,487	15,253	37,740
Unemployed	86	81	167	2,336	1,801	4,137
Labour Force	748	571	1,319	24,823	17,054	41,877
Out of Labour Force	253	519	772	26,558	34,703	61,261
TOTAL	1,001	1,090	2,091	51,381	51,757	103,138
Unemployment Rate	11.5%	14.2%	12.7%	9.4%	10.6%	9.9%
Labour Force Participation	74.7%	52.4%	63.1%	48.3%	33.0%	40.6%

Source: Espeut, 2006.

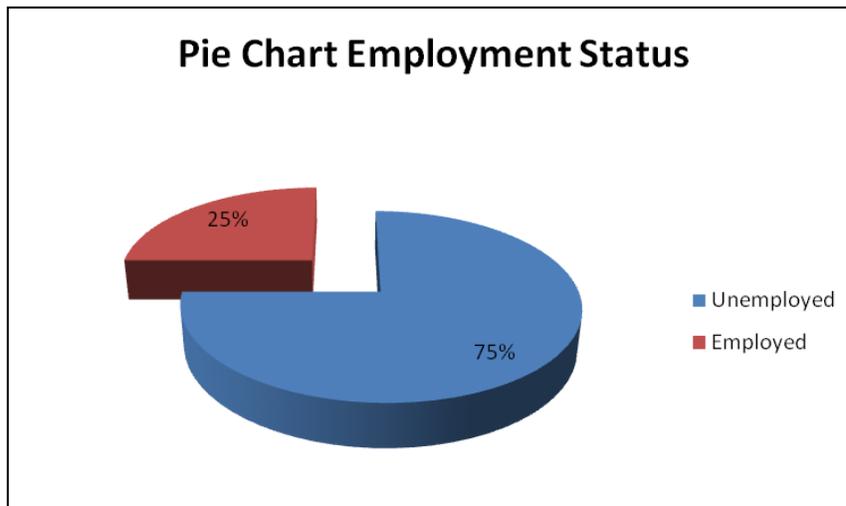


Figure 7. Employment composition, 2010 (source: Lewis and Marquez-Sylvester, 2010).

Figure 8 shows that, with the exception of New Hampshire, the majority of employed persons were working within the private sector, followed by Government employment and, thirdly, self-employment. More research into the types of private sector and Government employment is needed as it would aid in determining how dependent the communities are on the Reserves.

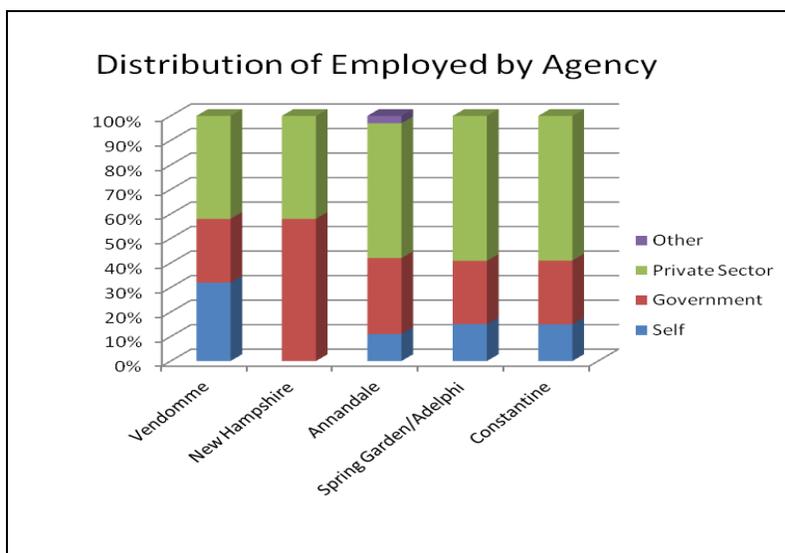


Figure 8. Age distribution by community and employer (source: Lewis and Marquez-Sylvester, 2010).

III/1.4.3. Education

Espeut's statistics below (Table 17) show that, educationally, the residents of the Annandale area are somewhat better off than Grenadians as a whole, although, in absolute terms, the standard is low. Proportionally, more project area residents had been to primary and secondary school than Grenadians as a whole, but less than 30% had been to high school. Although the statistical differences seem to be close to the margin of error for this data, this does have implications for planning and assessing the impacts of training.

Table 17. Highest School Attended, Persons 15 Years and Older, Annandale Area and Grenada, 2001.

	ANNANDALE AREA			GRENADA		
	Male	Female	Total	Male	Female	Total
None	0.3%	0.3%	0.3%	5.5%	5.2%	5.4%
Primary Low	7.0%	6.2%	6.6%	8.6%	8.5%	8.5%
Primary High	58.2%	53.4%	55.7%	51.0%	44.3%	47.6%
Secondary	25.8%	32.5%	29.3%	20.4%	27.4%	23.9%
Pre-University	4.1%	5.9%	5.0%	4.1%	5.7%	4.9%
University	0.9%	0.4%	0.6%	2.3%	1.7%	2.0%
Other/Not Stated	3.7%	1.4%	2.5%	1.9%	1.2%	1.6%
TOTALS (N=)	1,001	1,090	2,091	51,382	51,757	103,139

Source: Espeut, 2006.

III/1.5. Major Roads

At the Grand Etang Forest Reserve, the development of the St. George's-Grenville Highway, as well as approximately 35 kilometres of designated trails, has made recreational access to much of the Reserve relatively easy and has helped serve the recreational needs of residents and tourists. Several communities, such as Petit Etang, Annandale and Mt. Agnes, have undesignated trails leading to the ridges.

At the Annandale Forest Reserve, the old estate roads, as well as other tracks established to service the estate's crop production, serve as *de facto* trails for hunting and hiking, although Annandale remains relatively isolated by its distance from the St. George's-Grenville Highway.

III/2. Land Ownership in the Reserve Area

III/2.1. Private Land Ownership

During the post-colonial history of Grenada, citizens were given the right to own land. With the exception of the Grand Etang Forest Reserve, Mount St. Catherine and a few agricultural estates, most of the land in Grenada is privately owned. Private ownership means clear transferable rights, which has resulted in land being sub-divided among family members and passed on through generations. This has led to the development of very small holdings and difficulty in tracking the ownership of properties.

Annandale Estate was owned by the Sir William Branch family. Only the eastern portion remains after Government purchase in 1964.

III/2.2. Role of Private Holdings within the Reserve

There are no private holdings within the Reserve. The lands surrounding the Reserves, however, are private holdings, of which approximately 75 percent is under agricultural crops. This implies that there is considerable pressure, even on these upland areas, to convert natural forest to agriculture and that encroachments on the Reserves is likely to continue as a major obstacle to the operation of a Protected Area.

III/2.3. Public Land Ownership

Grand Etang Forest Reserve was established by the *Grand Etang Forest Reserve Act 1906*. The 1700 ha (4200 acres) Reserve is managed by the Forestry and National Parks Department of the Ministry of Agriculture.

Annandale Forest Reserve, with an area of 236.12 ha (590.30 acres), was established by a Government of *Grenada Gazette Notice* in 2006, with responsibility for its management also vested in the Forestry and National Parks Department of the Ministry of Agriculture.

III/3. Reserve Management

III/3.1. Day-to-Day Management

With the exception for the Grand Etang Visitor Complex, the Department of Forestry and National Parks continues to manage both Reserves from its headquarters in Queens Park.

Upland watershed, forest conservation and recreation issues affecting the Reserves are addressed by unit staff, reporting to the Chief Forester. Operational issues such as silviculture, road and trail maintenance, and ranger duties such as surveillance and detection, are conducted by field staff including three Rangers, five foremen and 22 field workers.

Thirteen workers are employed in Annandale in field operations, doing planting, weeding, harvesting, drainage works and road maintenance, in addition to a Forest Ranger and Forest Officers who supervise the Annandale operations.

III/3.2. Relationship with Other Government Agencies

III/3.2.1. The Ministry of Tourism

The Ministry is responsible for delivery of visitor programmes at the Grand Etang Visitor Centre complex and the licensing of the food, beverage and other vendor concessions. Entrance fees are collected by the Ministry of Tourism under the *National Parks and Protected Areas (Fees) Order, 1992*, and all are placed into the Ministry of Finance's Consolidated Revenue account. It should be noted that the *Finance and Audit Act of 1964* (Amended in 1986) does allow for monies collected by government departments to be deposited in other accounts by permission of the Permanent Secretary of Finance as long as it is into a separate account and set up as a trust with supporting regulations. There is potential for this process to be used to establish a Protected Areas Trust Fund.

Currently, 19 staff members of the Ministry of Tourism provide fee collection and greeting services at the Visitor Centre, vendor monitoring, security, landscaping and cleaning of the facilities.

III/3.2.2. The National Water and Sewerage Authority (NAWASA)

Under the *National Water and Sewerage Authority Act, 1990*, this agency manages the three dams and associated infrastructure in the Forest Reserves. NAWASA has "full power and authority over the waters" in the Reserves. No Memorandum of Understanding exists between the NAWASA and the Department of Forestry and National Parks to address common issues of present and future water demands, hydrologic research, maintenance of water levels at Grand Etang Lake, sedimentation and clearing of dams, environmental impacts of proposed developments, information sharing or forest conservation.

III/3.2.3. The Lands and Surveys Department

This department is part of the Ministry of Agriculture where it manages the granting of leases to establish communication sites. In the Grand Etang Forest Reserve, five sites have been established at Hurricane Ridge. From the standpoint of tourism development of the PA, the ridge has outstanding potential as an overview attraction. Poor maintenance of the communication sites are an impediment to this development, however, and the issue needs to be addressed, including the terms and conditions of the private leases for the tower sites.

III/3.2.4. The Ministry of Communications, Works and Transport

This agency manages the St. George's-Grenville Highway as it bisects the Grand Etang Forest Reserve. No Memorandum of Understanding exists between the two Ministries to address the issues of traffic at the Grand Etang Visitor Centre or roadside vegetation and litter control.

Grenada Electric Services Ltd. maintains an electrical transmission line in the Grand Etang Forest Reserve paralleling the St. George's-Grenville Highway. No protocol exists between the company and the Department of Forestry and National Parks to address management of the right-of-way or acceptable operating procedures within the National Park.

III/3.3. Outreach to Publicise the Reserve

On 17 March 2010, the Department of Forestry launched its community Livelihoods Project for the Grand Etang and Annandale Forest Reserves at the Willis Community Centre in the presence of NGOs, Government agencies, community groups and environmental representatives.

The Livelihoods Project for the Grand Etang and Annandale Forest Reserves was expected to receive an estimated US \$125,000.00 from the OECS Secretariat through OPAAL to be used for training persons in areas such as arts and crafts, tour guiding, agro-forestry and zip lining operations. Community persons should be able to access the funds through grant applications, where monies are to be used to enhance respective livelihoods. The IRF team understands that preliminary seed funds have been granted to the NICE from the OECS Secretariat for this purpose.⁴

The IRF team also found that while many persons were aware of the OPAAL project, many expressed concern that they had not been kept informed since the first community meeting several years. Many of these persons are artisans who have been operating for some time, but were in need of financial assistance to purchase machinery, stock and/or

⁴ An interview with the OPAAL Project Coordinator, Mr. Kelvin Dottin, revealed that they were awaiting the outcome of a feasibility study on livelihoods to identify projects which could be awarded grants between US\$5,000 and US\$9,000. There have been two previous studies on livelihoods.

other related items to upgrade production. A more flexible programme would help to separate those who need training from those who have sufficient experience and knowledge and could move ahead. Two examples of more advanced projects would be ice cream making at the North East Farmers Association and the timber harvester, Mr. Noel Niles.

III/4. Civil Society in the Reserves

III/4.1. Producers, Manufacturers, Harvesters-Hunters and Farmers

The following primary points are taken from Espeut (2006):

- Historically, commercial activities in the Grand Etang Forest Reserve have centered on modest forest production and the Annandale Forest Reserve continues with crop production, as it had been prior to government acquisition.
- There are Plantations at St. Margaret, Grand Etang, Vendome, Les Avocats and Petit Etang where selective harvesting was practiced for timber, fence posts and fencing. Most of the plantations, occupying some 260 hectares, are located on steep slopes with limited accessibility.
- In the Grand Etang Forest Reserve, commercial uses by adjacent communities for non-timber forest products such as bamboo, Donkey Eye, and bush yams, have been limited.
- In the Annandale Forest Reserve, the cultivated area of the old estate produced agricultural crops including bananas, cocoa, citrus fruits and nutmeg. Practices associated with maximizing crop production caused sedimentation and pollution of the Annandale water supply facilities and led to the Government's acquisition of the lands. Today, commercial uses, though minor, still include plantation forestry and harvesting non-timber forest products as well as tourism and eco-tourism. The Forestry Department also has an active Christmas tree production programme. The potential for these uses is significant to the livelihoods of the adjacent Annandale and Vendome communities.
- In the past, the Annandale property has been the focus for the hunting of wildlife, namely the armadillo (locally called "tattoo"), the manicou, the African monkey and the pigeon locally called "Ramier".
- Fishing, both recreational and subsistence, occurs in the streams of both Reserves and at Grand Etang Lake.
- Although both the tattoo and manicou are protected under Grenadian law, both are openly hunted in Annandale and across Grenada –for food and for sale. Although no scientific studies have been done, by all accounts both are overhunted.

An FAO-supported technical assistance and training effort is designed to develop "practical assessment tools to determine harvest rates of game species," in order to improve the ability of the Ministry of Agriculture to monitor the impacts of hunting on these wildlife species (FAO, Trinidad, 2011).

- During the Grenada Revolution the monkeys reportedly retreated into the mountains away from the gunshots resulting in considerable reduction in monkey hunting since then.
- The hunting of Ramier takes place all year round (*i.e.* there is no hunting season), but the birds do “move around” and are often not seen. This may also be evidence of over-hunting.

III/4.2. Services in the Reserves

III/4.2.1. Tour Operators and Forest Guides

As of 2007, six tour companies provide designated tours to visitors in the Reserves. In addition to the drive-through tour accessed by the St. George’s-Grenville Highway and stopovers at the Visitor Centre or Grand Etang Lake, several tours include guided hikes to Mt. Qua Qua, Seven Sisters and St. Margaret Waterfalls, and Fedon’s Camp. The most popular access to St. Margaret Waterfall traverses private land at St. Margaret. Visitors can leave their vehicles in a protected parking lot, obtain a guide, as well as food and beverages, and visit the waterfall.

III/4.2.3. Commercial Recreation

The Grand Etang Visitor Centre and its surrounding grounds are managed by the Ministry of Tourism with services provided by a variety of private-sector concessionaires under annual service agreements. These agreements are monitored by the Ministry from St. George’s. Ministry of Tourism on-site staff provides security, entrance fee collection, information at the Visitor Centre, and maintenance of the grounds and buildings.

For the Annandale Forest Reserve, work has been done on improving access to the waterfalls⁵, upgrading vendor facilities, washrooms, gardens and walk paths. Zip lining across the waterfall has been identified as a possible attraction.

III/4.3. Organisations of Civil Society

NGOs involved in participatory research and advocacy related to protected areas management and/or biodiversity conservation in the GE&AFR include:

- The Grenada Society for the Prevention of Cruelty to Animals
- The Grenada Horticulture Society
- The Grenada Hunters Association

⁵ The waterfall is actually outside the Forest Reserve, but Government has acquired approximately one acre of land to accommodate these visitor amenities.

- The Grenada Community Development Agency (GRENCODA)
- Agency for Rural Transformation (ART)
- Friends of the Earth (FOE)
- North East Farmers Association (NEFA)

As noted in Part I, Section 4.3.3 of this report, the OPAAL Project created a Site Implementation Entity (SIE) whose members came from the many communities surrounding the Forest Reserves. Most interviewees from the area commented that the SIE had not functioned as it had originally been explained to them; nor did they feel that they had been involved enough in decision-making regarding the management of the Protected Area.

III/5. Ecological Services Being Provided

Table 18 below illustrates the inter-relationship between the Forest Reserves and the ecosystem services they provide to surrounding communities in Grenada as a whole. It represents the 24 ecosystem services presented in the Millennium Assessment.

Table 18. Importance of Ecological Services to Communities.⁶

	Important	Not Important	Needs Research and Development
Provisioning Services			
Wild foods	x		
Biomass fuel		x	
Genetic resources		x	x
Biochemicals		x	x
Fresh water	x		x ⁷
Capture fisheries		x	
Aquaculture		x	
Livestock		x	
Fibre Crops	x		
Timber		x ⁸	
Regulating Services			
Air quality regulation	x		x
Climate regulation			x
Erosion regulation	x		
Water purification	x		
Pest regulation			x
Pollination	x		x
Natural hazard regulation	x		
Water regulation	x		
Disease regulation			x
Carbon sequestration			x
Cultural Services			
Spiritual values		x	x
Aesthetic values	x		
Recreation & ecotourism	x		

⁶ The values for each of the services represent a consensus among the IRF project team, reflecting both our individual research and the results of interviews with representatives of local communities, stakeholder groups, and Government of Grenada entities.

⁷ Water supply services need research and monitoring especially with respect to quality, yield, and runoff from different types of vegetative cover.

⁸ Timber harvesting may not be important on a national scale, but it has the potential to be a resource for a few local "lumberjacks" who can make a good supplement to their income. After Hurricane Ivan, persons were trained to remove/harvest fallen trees by the Forestry Department. There is an opportunity to re-engage these persons.

III/6. Economic Livelihoods Supported by the National Park

III/6.1. Alternative Livelihood Potentials

Research presented by Lewis and Marquez-Sylvester (2010) showed a mix of livelihood activities taking place within the communities, ranging from tourism, education, construction, health care services, agriculture and others not stated. However, when asked about their interest in other forms of livelihoods, 89% of those interviewed declared an interest in activities which mainly focused on tourism and agriculture, including:

1. Trail development
2. Hiking
3. Tour guiding
4. Agro processing
5. Agro forestry/ horticulture
6. Art and craft
7. Fish farming
8. Rock climbing
9. Cabin tourism
10. Bottling water
11. River tubing
12. Bee keeping

Activities one to six have been grouped into four logical groups for the discussion of stakeholder analysis in Section 1.3 above (Part III of this report). Obviously, all of the items on this list could be further parsed or differently aggregated. For general management guidance and planning, 12 discrete activities, implying 12 different management programmes, is probably too many, at least for several years into the programme.

Espeut's 2006 report on livelihood opportunities was similar in its recommendations on new ventures for engagement by the surrounding communities. Additionally, the IRF team's own interactions with many community members revealed that there was a desire to extend the tourism zones and tourist activities into the actual communities, thus creating "village trails" that would give tourists the opportunity to see crafts in production as well as Grenadian spices and other delicacies, in addition to increasing the production of local crafts such as baskets and mats on a larger scale. It was felt that the overall premise should be to market a complete "story" so that they are not just selling baskets but rather giving the visitor the opportunity to experience the process of basket-making from the gathering of the materials used in the forest, to the processing of the materials and on to the final product. A similar initiative could be pursued for cocoa or nutmeg.

The overall sentiment was that there is great potential to increase employment through tourism and agricultural activities, but the communities surrounding the Reserves will need to be well integrated into the PA's development and management. The belief was that this could be done through training, financing and technical assistance, but it also requires credible local institutions with both a mandate and respected capacity to achieve this potential.

III/7. Infrastructure Needs of the Reserve

III/7.1. Physical Infrastructure

III/7.1.1. Roads and Transport Systems for Visitors and Staff

The St. George's-Grenville Highway bisects the Grand Etang Forest Reserve, lending access to Grand Etang Lake and several trails in the Reserve. While 500 metres of public road connects the Annandale Forest Reserve with Annandale, it is in poor repair and will need considerable attention in order to attract more tour operators, taxi drivers and tourists into the community.

III/7.1.2. Trails

Most of the hiking trails which once connected the Annandale Forest Reserve to the Grand Etang Lake and to the Concord waterfalls are still blocked by fallen trees and landslides from the last two hurricanes. These could be reopened as well as new ones created. However, it should be noted that many of these trails have not been mapped, and the knowledge of their location lies with a few aging members within the communities. This means that exercises to clear and map these trails need to be implemented quickly using GPS technology to map the routes with relative ease, accuracy and transferability⁹.

Historical sites such as the Grand Etang Great House, Visitor Centre and Lake need to be restored, and interpretive and directional signs should be either upgraded or be placed at both Grand Etang and Annandale.

III/7.1.3. Water and Sewerage Systems

Turner (2007) states that the “National Water and Sewerage Authority manages three dams in the Reserves at Grand Etang, Annandale and Les Avocats as well as associated water pumping facilities. Water collected from the dam at Grand Etang is pumped into the Beausejour watershed within the Annandale Forest Reserve for contribution to the St. George's water distribution system.”

There has been general agreement that the primary function of these Reserves should be the protection of the country's water supply and, as such, no commercial or recreational activities should have any perceived or real impacts upon the water resources within the Reserves.

⁹ A useful exercise would be to collect interviews with some of these persons and record some oral history of what the trails were like, what they were used for, etc — again, to tell a story as well as re-create the trail. Mr. Reginald Perry of the North East Farmers Association is one such person who is thought to have the best knowledge of where the old trails are.

Concern was expressed by many persons interviewed about the advancement of weeds in the Grand Etang Lake, and efforts are ongoing by the Ministry of Tourism to remove them. They need to be disposed of properly so as not to cause ecological disruptions elsewhere.

III/7.2. Tourist and Recreation Facilities

Recreation and tourist facilities—including a visitor centre, viewpoints, trails, picnic shelters, parking, washrooms, vendor stalls, and food and beverage concessions—have been developed at Grand Etang Forest Reserve. The facilities, with the exception of the trails, are managed by the Ministry of Tourism. It is difficult to know how many visitors they attract as they are non-paying sites.

The trails and surrounding forest resources are managed by the Department of Forestry and National Parks. There is great potential to upgrade these sites so that they play a larger role in generating tourism revenue. Upgrades should take the form of signage and interpretive materials for the visitors. At present, nothing exists to inform visitors about Grand Etang itself (size, how formed, age, species present, etc.). Maps are needed of the trails available and information about the types of vegetation, flora and fauna.

III/7.2.1. Communication Towers

As stated earlier in Part III of this report, several communication towers exist (Hurricane Ridge), adjacent to the St. George's-Grenville Highway. The area has the potential to be a major tourist viewpoint for cruise ship and stay-over visitors. Unfortunately, damage done by Hurricane Ivan remains visible to date, and an absence of maintenance and appropriate design of communication facilities, including towers and supporting structures, significantly degrade the site and serve as a potential pollution source in the Grand Etang Forest Reserve.

III/7.3. Organisational and Social Capital Infrastructure

III/7.3.1. Working Capital

The Annandale and Grand Etang Management Plan gives an overview of revenue sources. It explained that:

...expenditures for the existing management of the Forest Reserves are financed by the Government Vote, by program, for the Ministry of Agriculture and, in the case of the Grand Etang Visitor Centre complex, for the Ministry of Tourism. Road maintenance in the Reserve is financed by the Ministry of Works. No effort is made in the current Ministry budgets to separate geographically the financial management of the two Forest Reserves from other management responsibilities of the respective Ministries (Turner, 2007).

The total Vote for the Department of Forestry and National Parks in 2007 in Eastern Caribbean Dollars for all Department responsibilities was \$1.29 million, of which \$1.04 million, or 80 percent, was for staff wages and salaries.

Revenue to the Government, realised in the form of entrance fees, sale of timber and vendor agreement fees, is paid directly into General Revenue. The Site Management Plan proposed that these revenue and expenditure streams continue as the Forest Reserves are part of an overall forestry and national park government programme. The Management Plan also pointed out, however, that the fees charged by the Ministry of Tourism to the private sector concessionaires appear to have no relationship to the actual business value of licenses. Similarly, the fees charged to visitors to Grand Etang (US\$1.00) have little relation to the services actually provided. Additional monies from increased entrance fees and from expected increased visitation due to better infrastructure, management and marketing could significantly raise additional revenues for the Protected Area.

III/7.3.2. Training

A *Protected Areas Training Needs Assessment* was completed by Parsram in 2007 as part of the Capacity Building component of the OECS Protected Areas and Associated Livelihood Project. The assessment recommended a list of training requirements. Notably absent is training for the public sector to improve its engagement with and enlistment of services from other Government bodies, civil society organisations and surrounding communities for the purpose of protected areas management. This method of training should also be considered, and efforts should be made to provide staff with these tools through accreditation and/or immersion (“on-the-job” or “counterpart” training) at other well-established Protected Areas or National Parks regionally or internationally. The Man and Biosphere (MAB) programme of UNESCO has had such a focus and there are Biosphere Reserves in the Caribbean, including the US Virgin Islands National Park on St. John.

Other institutions which can play greater roles in protected areas management and natural resource conservation should be identified and targeted for training as well so that greater collaboration can take place. For instance, the Land Use Division could be utilised more for generating GIS-based data.

To finance these and other initiatives (such as those listed below), funding could be sought from international donor agencies, and partnerships with Civil Society/NGOs could be pursued as often times they are able to attract funding from sources not available to governments.

Training needs identified by Parsram (2007) were as follows:

At the national level—

- organisational management and leadership
- communications
- project management
- fundraising
- protected areas financing
- identifying and building partnerships
- networking techniques
- community outreach and management
- integrated conservation and development planning
- participatory processes
- planning methods and management plan development
- protected areas regulation protection and enforcement
- protected areas systems and network planning
- tourism/associated livelihoods strategic planning operations
- education and awareness strategy/methods/tools.

At the site level—

- product development and marketing
- organisational management and leadership
- tour guiding skills
- cooperation/collaboration partnerships
- communication
- business management
- project development
- environmental education
- customer service training
- communication skills
- negotiation skills
- protected areas planning methods and management plan development
- site operations and management.

In 2010, Lewis and Marquez-Sylvester's research revealed that members of the local communities were desirous of receiving training in activities that allowed them to utilise the resources around them. Many community members desire to be involved in activities that did not harm the environment and their choice of mostly ecotourism-oriented ventures is a reflection of this ethos. Some notable areas where interest was expressed were arts and crafts, hiking tourism, agro-forestry, agro-processing, bee keeping, and cabin tourism.

III/7.3.3. Laws and Regulations

The Grand Etang Forest Reserve was established under the *Grand Etang Forest Reserve Act of 1906*. The Act did not assign management responsibility. However, the Forestry Department of the Ministry of Agriculture has assumed that role throughout the Reserve's existence.

The 1928 *Wild Birds and Animals Sanctuary Act* established the Grand Etang Forest Reserve as a "sanctuary for wild animals and birds". The Forest Reserve is also subject to the *Forest, Soil and Water Conservation Act* and the *Birds and Other Wildlife (Protection) Act*.

The Annandale Forest Reserve was established by a *Government of Grenada Gazette Notice* in 2006, and responsibility for its management was vested in the Forestry and National Parks Department of the Ministry of Agriculture. The lands comprising the Reserve were acquired by the Government some 40 years earlier and vested in an earlier iteration of the Forestry and National Parks Department.

In 2003, the Grenada Forest Management Project—Phase II Forestry and Wildlife Legislation Review, compiled with significant input from government and non-government agencies and the private sector, attempted to clarify protected area, forest and wildlife management responsibilities. This pending legislation is awaiting the preparation of accompanying regulations before consideration by Government.

Both Forest Reserves are managed under regulations accompanying the *Forest, Soil and Water Conservation Act*. However, better communication of its provisions is needed through signage and printed materials, as well as stricter enforcement by staff.

The *National Parks and Protected Areas Act 1991* is the most significant law dealing with protected areas and is the only one that contains provisions for development of a system of protected areas. It allows the Government to add land to a national park or declare a national park or protected area and also lists the purposes for which a protected area may be declared, these being (Gardner, 2006):

- Preserving the natural beauty of the area, including the flora and fauna
- Creating a recreational area;
- Commemorating an historic event of national importance; or
- Preserving an historic landmark or a place or object of historic, prehistoric, archaeological, cultural or scientific importance.

The Act however does not contain definitions of protected areas or national parks and, to date, the National Parks Authority has not functioned, one reason for this being that no Parks Commissioner has been appointed.

III/7.3.4. Operating Procedures

Past reports and plans have noted areas of discrepancies that exist in how the Reserves are managed; for instance Turner (2007) pointed out that:

... At the management level, the facilities at the Grand Etang Visitor Centre complex are managed by the Ministry of Tourism while the management of resources, including other recreation facilities, are the responsibility of the Department of Forestry and National Parks in the Ministry of Agriculture.

In addition, NAWASA currently has infrastructure facilities in the Reserves. The Ministry of Works maintains the St. George's-Grenville Highway and manages safety and vegetation in the highway corridor and the Lands and Surveys Department of the Ministry of Agriculture issues leases in the Reserves. To ensure that the protected area resources are protected, including scenery, it is essential that the Forest and National Parks Department have agreements with each agency on common issues such as location, design and management.

Separation of protected area management functions by agencies is almost always counterproductive as it tends to confuse responsibilities, leads to unclear or contradictory policies, delays decisions, institutionalises inefficiencies and thus threatens the protection of the natural and cultural resource [emphasis added].

III/8. Monitoring and Assessment of Environment and Socio-Economic Impacts

As the OPAAL Project winds down, there is a need to ensure that the increase in awareness of the potential for tourism in the two Forest Reserves is capitalised upon and sustainable management mechanisms are put in place to provide economic gains for the surrounding communities. The Project's coordination and management has been overseen by an OPAAL-created entity, the NICE (National Implementation and Coordinating Entity), which comprises mainly Forestry staff. The OPAAL Project also created a Site Implementation Entity or SIE, which was to be comprised of non-governmental stakeholders and community representatives and to provide project oversight and guidance and act as a direct link with local communities. Unfortunately, to date, it has not been meaningfully engaged. This will have to be rectified going forward to include wider involvement of other governmental and civil society representatives to achieve increased trust and buy-in for the GE&AFR National Park.

This environment and socio-economic assessment provides a baseline for evaluating potential impacts of project interventions and activities that have been put in place to implement the Site Management Plan. In 2006, the Forestry Department completed the World Wildlife Fund-World Bank Alliance Scorecard for both Reserves, with adaptations, to assist in reporting on the effectiveness of management of protected areas in the OECS region. The Scorecard—listing general criteria including legal status, enforcement, boundary demarcation, inventory, awareness, management needs, stakeholder involvement and facilities—was felt to be helpful in providing a basic structure and standard for assessing effective management, and the Department should be encouraged to carry through on its intention to update the Scorecard on an annual basis.

The Scorecard reflects a state-of-the-protected area snapshot and the studies, and assessments provide a base from which to measure overall changes. While helpful for comparison purposes with other areas in both Grenada and elsewhere in the Caribbean, monitoring and evaluation also needs to be specific to the Site Management Plan and the key actions identified in the Plan.

PART IV

SUMMARY and RECOMMENDATIONS

IV/1. Potential Obstacles to Implementing Site Management Plan

IV/1.1. National Preparedness for Protected Areas Development

There is agreement among the contributors to OPAAL project reports that Grenada needs to protect its biological, cultural and scenic resources. This is also expressed in government documents such as the National Environmental Policy and the National Biodiversity Strategy and Action Plan, as well as the Department of Forestry and National Parks' Strategic Plan and Forest Policy. Representatives of community organisations and NGOs, interviewed by the IRF team, spoke of impatience with the speed with which a well-functioning protected areas system was forthcoming—and, in particular, the pace with which meaningful involvement of their groups with the development of livelihood opportunities was being advanced.

IV/1.1.1. Demands of International Treaty Obligations

Grenada is signatory to several MEAs, including the Conservation of Biodiversity (CBD) and the SPAW protocol to the Cartagena Convention. Other major international environmental agreements include: the UN Framework Convention on Climate Change (FCCC), the UN Convention to Combat Desertification (UNCCD), Convention on Trafficking in Endangered Species (CITES), The Convention on Migratory Species (CMS), UN Convention on the Law of the Sea (UNCLOS), Montreal Accord on Green House Gases, the Ramsar Convention for the Preservation of Wetlands, and the International Whaling Convention. These are binding legal documents and signing on to them requires a commitment to carrying out the mandates of the Agreement and the decisions made at the various meetings of the Conference of Parties. Specifically, the reporting requirements of each Convention have come to be very burdensome on small counties with limited development and environmental staff. Thus, Grenada has committed itself to protecting its biodiversity through a number of such measures, including the declaration and management of protected areas in such a way as to provide protection for Grenada's biodiversity.

At times, it can appear that this overall legal obligation to protecting the nation's biodiversity is not properly understood or effectively implemented. Policy makers in Government and the legal establishment need to be regularly reminded of these obligations

through meetings and regional dialogue, particular to gauge how the country is progressing towards meeting its obligations.

The recently implemented sensitization seminar for media workers carried out by the OPAAL Project could be of considerable assistance in increasing the media's understanding of these obligations, which will improve its ability to report in a more informed and critical manner on each obligation.

IV/1.1.2. Promoting Capital Value of Environment in National Development Planning

It is critical that the development of individual protected areas and the success of the protected areas system be seen not only as part of the country's effort to protect its biodiversity and cultural/historic heritage, but also as an essential part of the nation's sustainable economic development—or, at the very least, as providing a basic foundation for economic growth.

This involvement in economic growth was not sufficiently emphasised in the management plan (Turner, 2007), even though there is considerable emphasis on both the potential financial contribution from the GE&AFR and the development of livelihoods associated with the successful operation of the two Forest Reserves. The figures provided for potential income generation by park-related activities indicate that with little change in its operation, more than half of the cost of the operation of the Forestry and National Parks Department could be generated by the GE&AFR alone, and this does not take into account secondary impacts and the substitution of high local financial impacts, instead of imported manufactured goods (*e.g.*, tee shirts from China).

This point needs greater exposure, as many politicians, and the public-at-large, still accept a division between “environment and jobs.” They see Protected Areas as drains on Government's resources, rather than as engines for development. Greater use needs to be made of examples from both within the region and outside where efficiently operating parks and protected areas have demonstrated highly significant economic growth in their surrounding buffer areas. Some useful examples of a range of management arrangements involving both public and private sector models might include the Bonaire Marine Protected Area, Bonaire; Virgin Islands National Park, St John, USVI; Soufriere Marine Management Area (SMMA), Saint Lucia; and the Off-shore Islands Conservation Project in the North East Marine Management Area (NEMMA) in Antigua.

IV/1.1.3. Weak Policy and Legal Support for PA Development

Perhaps, largely because of the lack of appreciation of the points raised in the section above, development of adequate supporting policies and legal structures for PAs in Grenada has generally been slow and confusing; and contradictory systems have remained

in place too long without political intervention to resolve the dilemmas emerging or reduce the structural weaknesses identified. Many of these weaknesses were accurately described by Gardner (2007), but little appears to have been done in the intervening period to address these issues.

Part of the difficulty in seeing the importance of Protected Areas lies in what may be called the “wood for the trees” syndrome. Developers approach governments with plans for a particular portion of land which they want to develop (the “tree” in this analogy). The value of the individual site is clearly seen in the context of the proposed development, but the value of the “wood”—that is, the whole collection of “trees” and the services provided by the whole ecosystem—is much more difficult to understand and, especially, to quantify.

Usually, insufficient work has been done to understand this part of the “wood”. Moreover it is sometimes difficult to draw a line and say that the removal of this particular “tree” will significantly damage the “wood,” and so the developer is given the benefit of the doubt and slowly the “wood” becomes degraded, “tree” by “tree,” rather than by any highly visible and alarming removal of “trees.” The “wood” is eventually replaced by a “thicket” or “lawn” and very few persons are aware of what has been lost.

Much has to do with difficulties that decision-makers face in evaluating or, in fact, putting a realistic value on the living capital that biodiversity represents. Many decision-makers are highly uninformed of the natural environment—for too many it is just “bush” – and they have seldom spent any time visiting protected areas and getting to know them. This puts the political leadership at a great disadvantage in protecting such resources, particularly when confronted by developers who are frequently much better informed about the particular resources of the sites they are interested in. The Grenadian experience with the delisting of the Mt. Hartman National Park in the fall of 2007—a major refuge of the globally endangered Grenada Dove—in order to permit the construction of a major Four Seasons resort, is one example.

Now that the OPAAL project is drawing to a close, the region and its individual island states will need to identify continuing sources of support for efforts that increase sustainable environmental development awareness among senior civil servants and other key policy-makers and policy-influencers, such as Permanent and Financial Secretaries and those in the legal services, as well as the media practitioners alluded to above. Training is needed also for environmental technicians and others involved in natural resource management and conservation to enhance their skills in influencing the decision-making process. Although no longer possible through OPAAL funding, a more systematic, long-term approach to accessing information and presenting it in innovative and effective ways at the highest levels of government is still needed in Grenada and elsewhere in the OECS sub-region. Too frequently, public service technicians are insufficiently creative and determined in the strategies employed with their PSs and ministers to fully convey the importance of biodiversity conservation and the value of biodiversity resources.

IV/1.2. Insufficient Access to Biological Asset Knowledge and Management

This brief baseline study, unfortunately conducted almost at the end of the OPAAL project, has—in the opinion of the survey team— earmarked the most important gap in knowledge about the GE&AFR area and its surroundings, namely, the inadequacy of our scientific understanding of this area. This gap includes the lack of comprehensive study and knowledge of the biological component and its distribution, the geology and soils, meteorological characteristics and water resources, as well as documentation of changes and events, such as hurricanes and droughts, which are of importance to understanding the behaviour and resilience of the various ecosystems and how they are likely to respond to change. This concern has been more fully described in the Environmental Site Report (see Part II).

IV/1.2.1. Biological Assets Not Documented

The Grand Etang Forest Reserve was declared in 1906; yet it appears from the published literature and from discussions with Department of Forestry staff that there is no comprehensive study of the forest assets of this reserve, neither of the general biodiversity to be found there, nor the proper monitoring and documentation of changes taking place over time. Though much more recently established as a forest reserve, having only been declared in 2006, the same concerns would apply to the Annandale Forest Reserve.

This is a serious handicap to the proper management of these reserves and more so if it is contemplated to manage these reserves as a national park, where many different uses would need to be planned for. This study has developed as comprehensive a list of the flora and fauna as was possible from a careful research of the published scientific literature. Yet in only 6 days of field work, the biodiversity team was able to document at least 6 previously unrecorded species from the area.

Our findings emphasise the need for a serious research effort on the area's biodiversity— on its species composition, their status and distribution, and on current ecosystems—a task particularly important in the post-Ivan/Emily period. Unfortunately, due to the lack of data prior to the passage of these hurricanes, it will not be possible to properly assess the full effect of these disasters in the GE&AFR and its surroundings.

The site management plan (Sec 2.2.2 Turner, 2007) makes mention of several forest inventories being made of the reserves, but none of those referred to makes mention of vegetation surveys, where attention is given to plant species' diversity rather than tree species important to conventional forestry. There does not even appear to be a reasonably researched plant species list for either of the Forest Reserves, let alone any biophysical mapping (see Environmental Baseline Study in Part II of this report). This report has attempted to provide one, but what was possible is known to be very incomplete and

lacking the comprehensiveness needed for proper management of these reserves as multi-use areas.

IV/1.2.2. Need to Grow and Use Domestic Technical Expertise

The management plan quotes the training needs identified by the Capacity Building component of the OPAAL project (Parsram, 2007) which lists 15 areas where training is needed. None of these had to do with biodiversity identification and documentation skills or training in use of equipment and techniques for species monitoring and distribution mapping.

Considerable interest was evidenced by the Forestry Department staff who accompanied the biodiversity assessment team on their field work, but it was also evident that while they had a useful working knowledge of the commercial tree species, they needed considerable strengthening in the area of identification, documentation and GPS technology skills in order to be able to carry out needed biodiversity surveys and mapping activities involving the whole range of biodiversity to be found in these reserves. Proper equipment is also apparently not available to support these types of studies. The Capacity Building for Protected Areas Planning and Management report does mention natural resources management, but is focussed on survey design and sampling methods, and techniques to gather information from communities, *e.g.*, participatory mapping, etc. The basic ability to identify the actual biodiversity to be managed and conserved was not included in this aforementioned report.

IV/1.2.3. Insufficient Access to External Expertise

It was clear from discussions with Forestry and National Parks Department staff that they would welcome assistance to upgrade their skills in the areas indicated in the preceding section. It is possible that there are botanists in Grenada who have the required knowledge and some effort to locate such resources from the public or private sector (including some of the post-secondary educational programmes located in Grenada, such as St. George's University) should be undertaken. However, if this is not the case, such technical expertise would need to be sought from outside Grenada, as would funding to employ a person or persons to provide assistance with the identification of plant biodiversity in the two Forest Reserves. It is possible that this could be done as part of a regional project, as it is likely that these skills are also lacking in other countries. An important part of this process would be the training of Forestry staff working alongside a botanical specialist(s) so that there is a transfer of skills over a significant period of time. Such skills need to become part of the forestry officer's basic training and practice in the field.

IV/1.3. Cross-Agency Administrative and Management Issues

IV/1.3.1. New Requirements for “Multi-Use” Protected Areas

Although we have not seen it mentioned in other OPAAL studies, the IRF team notes that there are important differences between a typical forest reserve and a multi-use area such as a national park. This may be because the IUCN definitions widely quoted by those dealing with Protected Area designation do not clearly spell out the functional differences and their implications for management between the various categories of Protected Areas.

A forest reserve, in most cases, is an area set aside for protection of the forests for future timber use or forest preservation, perhaps in order to protect an important or vulnerable watershed. It is usually managed by foresters for the forest trees present on the site. There is only one or perhaps a few very closely related uses of the forest reserve which is not open to the public or considered a place where community groups would be active or visitors would be encouraged, except for possibly some well-managed and monitored trails through the forest.

A national park on the other hand is specifically intended for multiple uses that include not only the protection of commercial trees, but also other kinds of biodiversity that are to be found in the area. Public activity is encouraged in these areas, though a national park may have zoned areas where public access is not permitted or is only permitted under strict control. In other areas, visitation and educational activities are not only permitted but also encouraged. This multi-use characteristic of national parks requires a much wider range of skills to plan and operate successfully than a typical forest reserve, which is concerned primarily with silviculture. The wide range of skills necessary for national park management is implicit in the skills listed by Parsram in his report on Capacity Building for Protected Areas Planning and Management and Associated Livelihoods report (Parsram, 2007). This list would certainly not be so broad for a forest reserve.

The proposed renaming of the Grand Etang and Annandale Forest Reserves as the “Grand Etang and Annandale Forest Reserve National Park may not be entirely appropriate as it is not clear whether the site is a Forest Reserve or a National Park. It may be better to simply call it the Grand Etang and Annandale Forest National Park. This name makes clear that the site is a national park and that it involves both forest areas.

IV/1.3.2. A Changing Human Resource Management Process

There are a number of issues with respect to the management of the site that have been raised in the site management plan (Turner, 2007) and also by Gardner in his review of the Policy, Legal and Institutional Frameworks (Gardner, 2007). Some recommendations were made with reference to the personnel skills and experience required, but in general little progress has been made in the past four years.

In the light of comments above about the different requirements of a national park as compared to a forest reserve, it does not appear to have been clearly stated that a visitor-oriented national park will require an operational structure and approach that is much more client-oriented than previous protected areas which were based on narrower, primarily conservation or regulatory functions. In fact, a national park needs an organisational system that is much more commercially “minded” and able easily to deal with a more “24/7” mode of operation, that is, able to respond quickly to changing client needs or to emergencies that are likely to crop up from time to time, operate easily outside of normal office hours and generally function more like the private sector agencies with which it will have to interface on a regular, day-to-day basis. Even the enforcement and regulatory functions of rangers will need to be supplemented to provide services whenever tourists or other clients need them and to provide a 24-hour surveillance function. Staff also need to be able to interpret the park’s resources, culture and history in a manner that is accurate, interesting, and easily understood.

It is not clear how well this new level of client-based operation can be achieved with current public service procedures, hierarchical structures, and the general absence of performance-based incentives. It is therefore recommended that current approaches to management of multi-use protected areas, including national parks, should be reviewed in the light of the observations made above.

IV/1.3.3. Broadening the Management Base – the NTAC, NICE and SIE

The OPAAL project required a three-tiered management system for guiding, coordinating and managing the project in each country. These included the **National Technical Advisory Committee** (NTAC) at the head with mostly an oversight and advisory role, followed by the **National Implementation and Coordinating Entity** (NICE), which was the national project manager, and the **Site Implementing Entity** (SIE), which was responsible for project implementation at the local level. All entities were established in 2005, but the IRF team found that they did not all function as planned and therefore sought to understand the reasons Grenada had diverted from the overall OPAAL structure as this may have implications for the protected areas programme moving forward. Our findings included the following:

IV/1.3.3.1. National Technical Advisory Committee (NTAC)

The NTAC was to be an inter-sectoral, inter-agency body made up of public and private stakeholders to monitor and guide the project. The original intention was for the NTAC to play a leading role in guiding implementation of the project. From discussions with the Forestry Department, members of the NICE and SIE, and with other local agency personnel and stakeholders, the IRF team came to the conclusion that the NTAC was not functional and that, after two to three meetings, it had been more or less disbanded. It appears there had been a loss of interest by many due to the slow pace of some project activities. Two Forestry Department staffers pointed to the lateness of the Management Plan as one example of why there was a significant drop in expectations by many (*pers. comm.*, Anthony

Jeremiah and Kelvin Dottin, January 2011). The Plan was to have been completed soon after the project commenced but was completed three years after the project's inception.

The project reportedly originated within the Ministry of Health and Environment, which then passed it to the Department of Forestry. It took time to make this transition, while, at the same time, the Department—along with the rest of Grenada—was still struggling in the aftermath of major storms in 2004 and 2005. The results of these storms and national recovery efforts consumed the attention and resources of Grenadians. This meant that some of the Government's and private sector's attention and interest needed for implementing the OPAAL project in Grenada were shifted elsewhere.

Going forward, careful consideration will need to be given to the capacity of the project's implementing agency (in this case the Ministry of Health and Environment) to manage the project throughout its lifecycle.

IV/1.3.3.2. National Implementation and Coordinating Entity (NICE)

The NICE was the body responsible for the management of the project in-country. The intention was to use already existing institutions with experience in managing the Annandale and Grand Etang Forest Reserves. This approach was meant to reduce the occurrence of duplicated roles and committee fatigue. In the case of Grenada, the members of the DF&NP formed the NICE, and the Chief Forestry Officer was made its Head.

This arrangement provided for a streamlining of the project's administration and execution within one government department. However, such centralisation also exhibited weaknesses. For example, the centralised framework lessened opportunities for broad-based stakeholder input and involvement in decision-making about park development, particularly regarding matters that will impact policy for the PA site after completion of the OPAAL project. With information-sharing and decision-making centralised within government structures, particularly in the Forestry Department, considerable effort will be required by Forestry to engage and re-engage communities, including training for its staff in community engagement processes and participatory natural resource management techniques.

The limited community involvement in the Grenada project will tend to leave site management more exposed when the OPAAL effort is completed. Even if the recommendation of the Site Management Plan to have overall management of the site returned to the DF&NP, there will still be a need to institute participatory management structures, given the wide range of clients and services of the new national park. This should be a priority of the DF&NP except without the assistance of OPAAL resources.

IV/1.3.3.3. Site Implementing Entity (SIE)

The SIE, headed by a protected areas manager, was to undertake the day-to-day management of the PA and related site-specific project activities. It should have included community groups and key individuals living in and around the Forest Reserves. Its role was to include assisting the manager in an advisory capacity, participating in the implementation of components 2 and 3 of the OPAAL project, participating in meetings of the NTAC, and advising and/or collaborating closely with the NICE on implementation of site activities.

The SIE, like the NTAC, did not function as originally intended. The IRF team found that many of its members, particularly community representatives, perceived that the project was primarily about developing livelihood opportunities, and when these did not materialise soon enough, most of its members became disillusioned. Many said that “they kept on going to meetings without seeing any tangible outcomes” (*pers. comm.*, Fitzroy Alexander, January 2011).

While community involvement in managing natural resources is important, many in the Grenada project had not had this kind of experience and did not understand the functions and roles of the various project groups and individuals in the overall execution of the programme. They would in the future benefit from more in-depth discussions on their roles and responsibilities; otherwise the expectation that their most important role is to extract revenue from the resource will persist.

IV/1.3.4. Inter-Agency Conflicting Priorities

One issue which was raised in the Site Management Plan was the functional “division of labour” between the DF&NP and the Ministry of Tourism (MoT)/Board of Tourism (BoT), whereby the DF&NP is responsible for the management of the biological and physical resources of the site and the MoT/BoT is responsible for the handling of visitors, most of whom are tourists from cruise ships and hotel guests. The MoT is presently also responsible for signage, but perhaps only at the main tourist sites such as at Grand Etang. However, it was not clear how these two government agencies actually liaise regarding matters of development policy or even day-to-day management of the site. The MoT/BoT has been able to make some improvements to the facilities and to the siting and presentation of vendors and “greeters” at Grand Etang and at the Annandale Falls (*pers. comm.*, S. Stiell, BoT, 2011), but there is a great deal more that needs to be done at Grand Etang by way of interpretation, availability of information, maps of the Reserve, directions to trails and signage in general.

The Site Management Plan called for the split responsibilities to be removed and for full responsibility for the site to be returned to the DF&NP. Government thinking on this recommendation is not clear at this point, but the improvements in management systems that are urgently required need to be decided in the light of the overall policy for protected

areas management as a whole and the future role of the, currently non-functional National Parks Authority and its relation to the DF&NP.

IV/1.3.5. Financial Issues Impacting PA Operational Revenues

Funding for the DF&NP's activities in support of the Grand Etang and Annandale sites are provided by Government from the consolidated fund and the annual budget. The Department presently does not have any separate accounting for labour, staff time or services and equipment used in site-related work. It is thus very difficult to account for the cost of managing the park at current or—if the system is not improved—at any future stage of development.

This is not a tenable situation for a national park which is intended to be largely self-supporting at least with respect to its operating costs.

In addition, in the case of GE&AFR, all the revenue is collected by the Ministry of Tourism, which operates the services and allocates concessions at the Grand Etang and Annandale Falls tourist attractions. The DF&NP still has the responsibility of managing and maintaining the biological and other resources, while receiving no recognition or benefit from the revenues collected. This situation does not lend itself to any kind of positive feedback or reward-based performance within the DF&NP and probably acts as a disincentive to its staff. This is not conducive for the development of a thriving, revenue-earning national park that provides its visitors an international level of service.

Again, these issues are intimately tied to whatever overall plan is put in place through the coordinating efforts of the NTAC to manage the system of protected areas and their financial arrangements.

IV/1.4. Stakeholder Participation Issues

The OPAAL project set out to promote not only participatory management of protected areas, but also the maximum engagement of community, NGO and other stakeholders to provide support for protected areas conservation and, by their inclusion, to provide a climate for understanding of and support for the biodiversity conservation objectives of the Protected Area System.

In addition, it was intended that the OPAAL project would lead to development of associated small- and medium-level business opportunities, which would not only support the surrounding communities but would also help cement support for the natural resources to be protected. Stakeholder involvement was therefore key to the success of the project.

If time had permitted, it would perhaps have been useful to conduct a survey of stakeholder organisations and individuals to try to better gauge their satisfaction with opportunities provided to facilitate their involvement and what they felt had been beneficial both to them and to the success of the project. In the event, this kind of survey was not possible, and the team was advised by some stakeholders that there would be resistance from some stakeholder quarters if asked to respond to such a survey. It was explained that many stakeholders had attended several meetings over the five or so years of the project, and their perception was that “there had been a lot of talk about opportunities and very little action to follow it up.”

While some of this may be justifiably blamed on some organisations’ tendency to depend on Government to take the initiative in such matters, there did appear to be some merit to some of their concerns, given the, perhaps unavoidable, late start of the Associated Livelihoods Programme in 2010. Even then, some stakeholders complained of meetings being held and promises made to get things moving and then of hearing nothing from the person responsible for long periods of time.

IV/1.5. Development of Associated Livelihoods

The reports of several previous consultancies suggest that good success was obtained in getting fairly comprehensive involvement of a wide range of stakeholders, whose expectations were apparently raised to quite high levels after the first 2-3 years of the project (*pers. comm.*, Tyrone Buckmire, 2011). However, the current IRF socio-economic survey team, speaking with people looking at the end of the OPAAL intervention, received several reports of dissatisfaction at the slow pace with which these expectations were being fulfilled, apparently as a result of disaster-related slowness in the decision processes, and inflated expectations that had been repeatedly frustrating and seemed to be delivering a less comprehensive form of sustainable development assistance than had been originally discussed.

The same causes seemed to stimulate a perception that the selection of enterprises to support the livelihoods training programme approach was very narrow or inflexible. All persons were apparently receiving the same training irrespective of their level of experience, demonstrated expertise, or readiness to proceed with development or expansion of their enterprises. This approach may have resulted in some interventions being held back for some of the more developed organisations that one would assume could have gone ahead.

IV/2. Recommendations

IV/2.1. Improve Scientific Understanding of the Site

IV/2.1.1. Completion of Thorough Baseline Studies for Site

There were several issues identified that the IRF team felt strongly need to be addressed if the GE&AFR is to develop according to the vision that has been anticipated for it. These are as follows:

1. ***A comprehensive assessment of the ecological resources existing in the Grand Etang and Annandale Forest Reserves*** is urgently required. The current baseline study does not have the resources to accomplish more than a brief and cursory survey. However, as noted above, even with only a few days field work, several new species of plants were identified close to well-used areas. Without a more comprehensive knowledge of the species present in the reserves and some better idea of their distribution, habitat requirements, and population dynamics, there is little scientific basis to identify priority biodiversity conservation issues.

The team felt that the basic knowledge of the biodiversity in the GE&AFR was still poorly known and needed much more urgent and sustained attention. The team has been told that there is a current study on the resources within forest reserves in Grenada, but the Acting Chief Forestry Officer assures us that he knows of no such study and asked our assistance in securing more information about it, if we find it.

2. There is also an urgent need to ***upgrade the skills of the Forestry and National Parks department staff in biodiversity identification, documentation, database creation, and management*** as well as in use of technical methodology and equipment to assist in this process, including survey and monitoring methods, use of GPS equipment, simple mapping techniques, vegetation monitoring and sources of information and expertise to support these activities.
3. There is a regional need for a ***technical support agency to assist individual countries of the OECS in identification and management of biodiversity and ecosystems and to provide a technology service in support of protected area management.***

IV/2.1.1.1. Species and Ecosystems Surveys and Identification of Conservation Priorities

These activities are needed with some degree of urgency as the knowledge of the biological resources needing protection is severely lacking. Some proposals have been made (see Part II of this report) for a programme of biodiversity surveys and monitoring and the documentation of the findings of this scientific research.

This will involve both as much internal technical expertise as possible, collaborating with local experts and botanical specialists where they exist and are available. External

assistance will likely also be needed and funding will need to be sourced to support this research programme. IRF has provided some indication of a potential programme of work that would assist significantly in the supply of the information needed.

The research programme must be integrated with the work of the Forestry staff and used as an in-house training programme to build the department's skills in areas of biodiversity management.

IV/2.1.1.2. Mapping of Above Information

The Ministry of Agriculture has a well-equipped and staffed GIS Unit within the Land Use Department. This is a very useful resource, but its existence does not seem to have resulted in the use of GIS technology in the Forestry Department. Additionally, the DF&NP does not appear to have staff with significant GIS skills even though mapping of forest resources should be an important function of the Department. While some GIS software is expensive and not easy to use without a significant level of training, use of GPS technology to mark the location of specific features of importance or to map trails through the forest could much more easily be taught to Forestry field staff and then fed to the GIS department to produce the required maps or data files. There are also opportunities to use GIS programmes that are available for free download from the Internet that could be used for simple mapping of waypoints, documenting the positions of forest species or features as well as representing tracks developed from GIS data.

IV/2.1.1.3. Water Resources Assessment and Management Needs

Although the relationship between the DF&NP and the National Water and Sewerage Authority (NAWASA) seems to be a cooperative one and NAWASA is able to carry out its maintenance and development activities in the reserves without conflict, it is a *potential* weakness with respect to the future management of water resources. As water resources are one of the most significant environmental services provided by the two forest reserves, a proper written agreement or MoU between the two agencies should be formally entered into by the two government agencies. This is especially important given the intention to increase visitor access and to provide additional incentives for attracting visitors to the forest reserves.

It also would appear that there is little current research being conducted on the effect of vegetative cover on water yield from the reserves. The removal of forest after Hurricane Ivan would have provided a good opportunity to look for changes resulting from the levels of deforestation, but this was not possible since adequate baseline data had not been gathered prior to the storm. Such studies should be seriously considered and could possibly be funded under the climate change funding programme that USAID is funding through the OECS-ESDU.

IV/2.1.1.4. Develop Monitoring Plan

The above comments can be more widely applied to the need for more general monitoring of the Reserves with respect, not only to its vegetative cover, but also to other biodiversity.

Training in these areas can be provided by organisations such as the Society for the Conservation and Study of Caribbean Birds (SCSCB), which has many training opportunities in bird identification and supports regular bird counts at various times of the year. There may be other local or regional centres where training in such activities can be provided, such as the Asa Wright Nature Centre in Trinidad, which carries out regular bird counts on its own forest areas as well as in various locations in Trinidad and Tobago.

This training could include the planning of monitoring programmes.

IV/2.1.2. Development of Zoning Plan for the Site

Once a better understanding of the biodiversity resources has been obtained, it would be possible to begin looking at the zoning of the GE&AFR to better manage the known threats to the biodiversity identified. This has been recommended already, but it is important that the proper sequence is followed so that the necessary resources are in place before a particular activity is undertaken.

IV/2.2. Provide Sustained Approaches for Increasing Civil Society Capacity to Participate in Protected Area Management

Everyone recognises that for the protected areas to be successful in attaining overall objectives and become the generators of income and employment, while providing protection to the biodiversity, support from a wide cross section of the population is important. Civil society can generate a significant amount of that support.

In addition, significant knowledge and many skills can be accessed through civil society organisations and individuals, which are very useful in the management of biodiversity. In some countries, including most recently, St. Kitts and Nevis National Trusts have been established as quasi-NGOs for administering public protected areas.

IV/2.3. Training and Capacity-Building Needs

This report discusses the need for scientific and technical training of forest officers to enable them to better understand and manage the complex web of biodiversity present in the GE&AFR. In evolving from Forest Reserve to National Park status, staff will need to appreciate the difference between a conventional forest reserve (where focus is on the timber species that are the main interest for effective management) and the management of a multi-use protected area or national park where the whole of the biodiversity and its component ecosystems is of concern. Understanding the variability of natural ecosystems in response to the introduction of new stressors will require adaptive management and the use of techniques and equipment to support scientifically sound ecosystem-based management.

As discussed above, the late start to the enterprise training programme and the reaction of local stakeholders to an approach many characterised as less flexible than expected, may require further efforts to recover the confidence of future participants. Additionally, perhaps more use can be made of the training resources of existing agencies such as the Small Business Development Centre in order to provide continuing training and support.

The main objective of the OPAAL project was “*to contribute to the conservation of biodiversity of global importance in the Participating Member States by removing barriers to the effective management of protected areas (PAs), and **increasing the involvement of civil society and the private sector in the planning, management and sustainable use of these areas***” (See OPAAL Project Brief, December 2004).

One would expect from this project objective, that there would have been a consistent effort to recruit NGOs and community-based organisations and their members (as well as the private sector) in capacity-building programmes to enable all to play a more decisive role in the management of the GE&AFR. NGOs that were interviewed in the course of the IRF field visit and in subsequent follow-up calls were not fully aware of opportunities for such cooperation, probably because of the foreshortened period for the development and implementation of the livelihoods activities. This remains an opportunity for future action.

IV/2.4. Management Systems

Various reviewers of bio-conservation organisational infrastructure in Grenada have made reference to weaknesses in systems currently in place for the management of both forest reserves, as well as for a more comprehensive, yet-to-be-developed national system for all protected areas as a whole (Gardner, 2006; Turner, 2007; Turner, 2009).

The site management plan (Turner, 2007) recommended restoring full management responsibility for the GE&AFR to the Department of Forestry and National Parks along with providing the training identified as required by Parsram (Parsram, 2007). However, a subsequent report by the same author (Turner, 2009), in laying out the possible development of a Protected Areas System for Grenada, suggested an eventual transition to a more centralised system for management of all Protected Areas under one structure.

This would involve setting up, through the resuscitation of the National Parks and Protected Areas Act and the appointment of a Director of National Parks, a new administrative structure that would manage both terrestrial and marine protected areas as well as any new areas that may be declared. The new entity would include management units with specific responsibility for Conservation and Planning, Visitor Services, and Finance and Administration.

The structure would hopefully provide some cohesion and economies of scale and more efficient use of human and financial resources. However, it would effectively remove protected area responsibilities from established agencies like the Fisheries and Forestry

and National Parks Departments, although it would retain the responsibility for protected areas within the Ministry of Agriculture. The plan also envisages management of specific PAs being contracted to outside agencies, which, under the Act, could be non-governmental organisations.

No action has been taken on any of these recommendations, although doubtless the on-going problems of post-Ivan recovery have been a continuing brake on change and reform. In the interim, the Parks Commissioner or Director has not been appointed, as required under the National Parks and Protected Areas Act. The lack of a more effective institutional framework, voids in key leadership positions, and a history of inaction on these issues, creates a steeper climb for innovations such as OPAAL.

IV/2.5. Financial Arrangements

Financial management has also been the subject of several proposals starting from at least 2006, with a study undertaken by The Nature Conservancy (TNC) on financial support for Grenada's commitments to PAs development under the Convention on Biological Diversity (CDB, Sector, 2006) and by Mel Turner (Turner, 2007 and Turner, 2009)

The key issues to be addressed appear to be:

1. The identification of sufficient revenues to support an expanded and improved Protected Areas System, when current Forest Reserves and MPAs are provided only basic support under Government's allocations to the respective Ministries and funding is not specifically dedicated to Protected Areas.
2. The confirmation and clarification of a fiscal framework for the country's PAs, whereby revenues generated by the Protected Area System are retained for the system's support and development. Gardner, in his analysis of institutional arrangements for Protected Areas (Gardner, 2007), did indicate that it is legally possible for Government Departments to deposit revenue collected as a part of their activities in a dedicated account, with the agreement of the Permanent Secretary, (Finance) under the Finance and Audit Act (as amended in 1986) as long as certain conditions are met. However it is not clear whether this facility has ever been utilised. It is also not clear whether there is sufficient commitment within the Ministry of Agriculture to give its support to such an arrangement. It is also not known whether in the long run—with possible success in generating revenues from, for example, fees—the Ministry of Agriculture would not feel obligated to use these funds to supplement its ongoing programmes.
3. The assurance that funds generated from PAs will remain secure and protected from utilisation by other agencies of Government in the medium- to long-term. This is particularly critical given the potential for significant revenue streams from PAs, as forecast by several studies and the experience of other PAs in the region, and if revenues generated are intended to support PA operating costs and provide for

ongoing PA development through financing from donor agencies or private sector gifts. This kind of support will be difficult to generate if funding security is not established.

One solution to some of these issues is the establishment of a sub-regional (or national) conservation trust to provide extra incentives to finance the capital costs of island-level biodiversity conservation. This concept has been promoted in the Eastern Caribbean for at least a decade by the US Agency for International Development. With new emphasis provided by the Caribbean Challenge of the Global Island Partnership (GLISPA—an initiative sponsored primarily by The Nature Conservancy), there may be new funding resources available to programmes like the GE&AFR National Park. In this, Grenada may have special credibility because one of the long-time GLISPA leaders is the Reverend Spenser Thomas of Grenada.