

Fifth National Report
to the Convention on Biodiversity
GRENADA



GRENADA DOVE (LEPTOTILA WELLSI)

National Bird of Grenada

July 31, 2014

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LIST OF ACRONYMS AND ABBREVIATIONS

ABS	Access and Benefit Sharing	MEA	Multilateral Environment Agreements
AOSIS	Alliance of Small Island States	MOA	Ministry of Agriculture
CBD	Convention on Biological Diversity	MOF	Ministry of Finance
CCI	Caribbean Challenge Initiative	NBA	National Biosafety Authority
CITES	Convention on International Trade in Endangered Species	NBSAP	National Biodiversity Strategies and Action Plan
COP	Conference of Parties	OECS	Organization of Eastern Caribbean States
ECCB	Eastern Caribbean Central Bank	OPAAL	OECS Protected Areas and Associated Livelihood
EIA	Environment Impact Assessment	PGR	Plant Genetic Resource
FAO	Food and Agriculture Organization	PGR	Plant Genetic Resources
GDP	Gross Domestic Product	PPU	Physical Planning Unit
GEF	Global Environment Facility	RAMSAR	Convention on Wetlands of International Importance
GMO	Genetically Modified Organisms	SBSTTA	Statutory Body on Scientific Technical and Technological Advice
GOG	Government of Grenada	SDC	Sustainable Development Council
HDI	Human Development Index	SFM	Sustainable Forest Management
IAS	Invasive Alien Species	SLM	Sustainable Land Management
IUCN	International Union for Conservation of Nature	SPAW	Specially Protected Areas and Wildlife
IWCAM	Integrated Watershed and Coastal Area Management	SWOT	Strengths, Weaknesses, Opportunities and Threats
LADA	Land Degradation Assessment for Drylands	TPA	Terrestrial Protected Area
LADMoN	Land Degradation Monitoring Network	UNCCD	United Nations Convention to Combat Desertification
LBS	Land Based Sources of Pollution	UNDP	United Nations Development Project
MBMPA	Molinere-Beausejour Marine Protected Area		
MDG	Millennium Development Goals		

Executive Summary

Background:

Grenada ratified the Convention on Biological Diversity (CBD) on August 11, 1994. In keeping with its obligations under Article 26 of the Convention Grenada has previously submitted four (4) national reports. This document constitutes the Fifth National Report to the Convention prepared pursuant to decision x/10 of the Conference of the Parties.

The Fifth National Report has been completed in parallel with the review and updating of the National Biodiversity Strategy and Action Plan (NBSAP) and in accordance with the published document entitled "Guidelines for the Fifth National Report" which was agreed by the Parties to the Convention

This report is supplementary to the previous reports, thus focusing on developments since the last national report including progress achieved towards the Aichi Biodiversity Targets.

Context:

Social conditions in Grenada have influenced the national approach to biodiversity conservation and environmental sustainability. Biodiversity conservation as a means to alleviate the plight of the poor through practical community-based activities to enhance livelihoods and investments in the health, wellness and education sector was deemed necessary for economic and social transformation in Grenada.

The impacts of climate change, loss of biodiversity and land degradation are viewed as the most important environmental issues facing Grenada and constitute the greatest threats to the economic well-being and livelihood of the population. The impacts of recent hurricanes and droughts are evident throughout the country. In 2004, Category 3 Hurricane Ivan brought damage to the country to the tune of over 200 per cent of the GDP. One year later, Hurricane Emily, a Category 1 hurricane, struck and again set back the economy. Grenada experienced its most severe drought in 2009-2010. The rainfall deficit in 2009 and 2010 was estimated at 50 per cent and 80 per cent respectively (MOA, 2009). Grenada's environmental profile remains very fragile and vulnerable to external shocks.

In response, Grenada has embarked on several strategic and sector-based initiatives to enhance the national capacity and resilience to cope with these events and phenomena. The initiatives include the elaboration of the National Biodiversity Strategy and Action Plan, the National Capacity Self-Assessment, the National Climate Change Policy, the Pilot Program on Climate Resilience, the Sustainable Land Management Policy, the National Hazard Mitigation Policy and the National Environmental Management Policy, Strategy and Action Plan.

Despite its small size, Grenada possesses a relatively high degree of biodiversity which is essential to the provision of ecosystem goods and services. Looking through the lenses of forest biodiversity, freshwater biodiversity, coastal and marine biodiversity, the paper outlines the main threats and the attendant implications for livelihood.

Forest:

The main threats that forest biodiversity faces include the clearing of the land for agricultural production and tourism development, animal tethering, housing settlements, infrastructure and commercial activities. Additionally, forest biodiversity is also threatened by natural disasters, including hurricanes, forest fires and pest infestation.

Grenada's wildlife species face habitat destruction, unsustainable extraction and bad hunting practices. The main reasons for these threats include lack of or limited public education, limited enforcement and monitoring, lack of adequate legislation and invasive alien species

Grenada's forest communities were severely affected by Hurricane Ivan, with intense impairment to asset functioning. Most terrestrial forest ecosystems are currently in a recovery phase dominated by secondary forest with pockets of climax forest. With respect to mangrove forest, replanting efforts have achieved over 50% restoration of mangrove communities.

A significant portion of Grenada's population depends on the forest ecosystem for goods and services as their main source of income. Several communities are located within and in close proximity of the forested areas given the small size of the country. The forests support the livelihood of these communities

Fresh Water:

Grenada's freshwater ecosystems suffer primarily from improper domestic solid waste and liquid disposal, overexploitation of species, unsustainable agricultural practices (including the use of weedicides and pesticides), saline intrusion, deforestation, and introduction of alien invasive species and extensive use of freshwater for domestic and commercial purposes. The freshwater ecosystems are critical for Grenada's water supply and food security. The freshwater resources are the bed rock for the tourism and agriculture sectors and constitutes the main source of livelihood for the citizens of the country.

Marine and Coastal:

Grenada's marine and coastal ecosystems are overexploited, overused and in some instances destroyed. Commercial species are overexploited. There is overuse of the coastal ecosystems for agricultural, energy, tourism and construction purposes. Beach sand mining, pollution through dumping of solid and liquid wastes, poaching and illegal

extraction of resources, unsustainable agricultural farming and fisheries practices, habitat destruction and disturbances in the food chain and spillage of oil-based substances have been widely reported as a main threat to the coastal and marine ecosystems.

The marine and coastal ecosystem of coral reefs, mangroves and sea grass beds provide spawning, hiding, recruitment and foraging habitats for assemblages of reef species, migrant pelagic and vagrant species. The common threats are identified as marina construction, villa residents and condos, nutrient loading, yacht anchorage, turbidity from land sourced sedimentation, agricultural run-off, sewage disposal and pollution, coastal sand mining and invasive alien species. The Orinoco green water is also credited for occasional major fish kill in Grenada.

Special mention must be made to the main invasive alien species affecting Grenada's marine and coastal ecosystem namely lion fish (*Pterois volitans*). The lion fish was sighted in Grenada waters in October 2011. The species is considered to be especially threatening because of its high fecundity, its short life cycle, its apparent isolation from known predators and its wide diet-breadth.

As indicated the Grenadian economy is dominated by services primarily in the tourism sector. The marine and

coastal ecosystem accounts for a major portion of the country's gross domestic product.

Agriculture and Land Use:

Grenada faces many challenges in managing its rich natural resources. Population growth, infrastructural development, as well as unsustainable global, regional and local production and consumption patterns, drive the increasing demand for, and extraction of raw materials and other natural capital as well as destruction of natural resources. This has led to the extensive conversion of natural environments to generally unsustainable productive systems, resulting in drastic impacts on Grenada's biodiversity.

Agricultural biodiversity's challenges are in the ever-changing land use and loss of vegetated lands. This also creates conditions for soil erosion and siltation of rivers and coral reefs. This can result in a loss in habitat for wildlife and reduction in flora and fauna. There is also a decline in the use of traditional crops and domesticated animals in Grenada. In addition there is also the threat of genetically modified organisms (GMOs) that can cause genetic erosion if they escape into the wild. Other threats include the impact of natural disasters, especially tropical storms and hurricanes, the increasing use of pesticides and insecticides, the introduction of invasive alien species and pest infestation.

Biodiversity in agricultural landscapes depends largely on the intensity of land use as measured by input variables such as chemical fertilizer, pesticide use and ploughing frequency (Reidsma et al, 2006). Petit et al (2001) posits that agricultural intensification would become the most important pressure on biodiversity in the coming decades.

Officials within the Ministry of Agriculture reported that while agrochemical dependent vegetable and root crop production increased within the last decade, the practice of agriculture became less intensive. This they appraised is linked to reduced importation of ecosystem damaging pesticides by the Pesticide Control Board, decline in fertilizer use correlating to higher prices, and the continued demise of the banana industry. The use of brushcutters and trimmers⁰ increased substantially at the farm level, a likely indicator of diminishing reliance on herbicides.

Livestock production on the contrary became increasingly intensive post 2000 due to reduction in available lands, fueled by a heightened focus on a growing real estate industry and associated increase in physical development. In Carriacou, the culturally enshrined "leggo season" is less evident. Generally, livestock is

currently managed using a smaller land area, with increase input intensity.

Although technicians and some resource users agree that agricultural activities negatively impact ecosystem health at the site and landscape levels, very little credible data is available to corroborate this perspective. A recent study however, conducted in 2013 to assess the impact of discharges emanating from the Beausejour and other nearby rivers on coral reefs in the Moliniere Beausejour Marine Protected Area (MBMPA) pointed to agriculture as a major underlying cause of pollution.

National Response:

Ten of the twenty Aichi targets were deemed to be the most important for the Grenadian context. The key criteria employed in this determination were linkages to income generation, poverty alleviation and livelihoods, relevance to Grenadian resource endowment and culture, current state of biodiversity and availability of resources. It was however quite clear that all twenty targets were quite important, interconnected, crosscutting and relevant for Grenada and that the prioritization was mainly to assist in the planning for the short to medium term because of resource constraints.

⁰ Commonly referred to as weedeaters.

The ten priority targets identified were as follows:-

- Target 1: Awareness and valuation of biodiversity
- Target 2: Integration and mainstreaming
- Target 6: Sustainable management of marine resources
- Target 7: Sustainable Agriculture, aquaculture and forestry
- Target 10: Coral reefs and vulnerable ecosystems
- Target 11: Protected areas increased and improved
- Target 14: Ecosystem restoration
- Target 17: Implementing NBSAP
- Target 19: Knowledge, science and technology shared and applied
- Target 20: Resource mobilization increased

It was clear that the above priorities were based on the appreciation of biodiversity on the sectoral level. Hence issues relating to coral reefs, forests, mangroves, agriculture, fishing, water, health and livelihoods were most dominant. The need for human and financial resources, public education, awareness, integration, collaboration and mainstreaming was also quite dominant in the national consultations.

The issue of high level leadership was also raised. There was the view that Grenada's profile on biodiversity should facilitate the political will for action to achieve the priority targets.

A cluster of key principles to be applied on the national level and several priorities to guide national interventions were agreed as follows:-

Principles:

- Equity and social justice must underpin national interventions
- Participatory governance and holistic approaches must be integral factors
- Specific focus must be on Sustainable economy
- Ecosystem based approaches are fundamental and most relevant in Grenada context
- Public awareness, education and capacity building on biodiversity are national imperatives
- Biodiversity must be perceived as part of the national heritage

Priorities:

- Environmental governance to be elevated in national decision making
- Review, drafting and implementation of environmental policies and legislation including the development of institutional and administrative frameworks and mechanisms.
- Specific legislation on water management, land use policy and enforcement and accountability mechanisms.
- Education and public awareness aimed at greater appreciation of the importance of biodiversity to livelihoods and the need for behavioral change for conservation of biodiversity.
- Knowledge management through research, data and information management, valuation of biodiversity, use of appropriate technologies and systems for conservation.
- Capacity building and institutional strengthening for enhanced cooperation and collaboration.
- Demonstration projects for land use, species conservation and livelihoods and sustainable job creation.

- Protection of genetic biodiversity through research and development of germplasm banks.
- Financial resource mobilization from internal and external sources including innovative sources for implementation of the revised and updated NBSAP.

Policy, Planning and Legislative Frameworks

Extensive work has been done previously on the policy, planning and legislative frameworks relating to biodiversity conservation in Grenada. A range of new policy and planning documents were elaborated on the national level and several new pieces of legislation were enacted. Nevertheless, there are many existing gaps. Additionally, these frameworks must have the inbuilt flexibility to respond to changes in national circumstances relating to biodiversity. For example, the issue of access and benefits has not yet factored in these frameworks thus requiring specific actions.

Nevertheless, it was generally recognized that Grenada was replete with policy, planning and legislative frameworks with respect to biodiversity conservation.

Lack of enforcement was identified as the key challenge. This is compounded by a lack of leadership on various levels and the lack of appreciation on the long term impacts of biodiversity loss and the role that biodiversity can play in addressing national social and economic ills.

There was a call for updating some of the existing legislation but in the main it was generally agreed that adequate frameworks exist for biodiversity conservation.

Effective national action highly depends on developing institutional, policy and legal framework that support effective planning for and management of biodiversity. The benefits gained from conservation and sustainable use of biological resources and the environmental, social and economic costs associated with the loss of these resources must be considered when dealing with national decision-making.

Biodiversity Mainstreaming:

There are many gaps listed below that exist in Grenada with respect to the effective mainstreaming of biological diversity and the following issues need to be addressed in a timely manner:

- A national policy for land management;
- Incentives for the protection of critical ecosystems on the island (biodiversity hot spots and endangered areas);
- Proliferation of Modification of policies which negatively impact the environment;
- Implementation of appropriate policies and strategies that contribute to the conservation of biodiversity;
- Effective enforcement of existing legislation;
- Outdated legislation to include the regulation of activities with significant adverse impacts on key habitats and species of significance;
- Awareness amongst the policy makers and stakeholders on the value of biodiversity, its sustainable use and conservation;
- Comprehensive information for use;
- Baseline biological/environmental data and inventories on key species and habitats;

- Management plans for key ecosystems, biological and genetic resources;
 - Focus on Institutional strengthening;
 - Development of a local repository for representative samples of biodiversity;
 - Environmental costs should be incorporated into the planning process;
 - Inclusion of elements of marine biodiversity within conservation areas, plans and strategies, and the need to conserve them effectively and preserve any potential options for their sustainable use and enjoyment;
 - Need to identify elements of biodiversity under threat such as rare, endemic and endangered species and vulnerable habitats;
 - Need to identify areas of biological diversity of greatest significance for local conservation;
 - Strategy needs to be developed for the continued over-exploitation and loss of commercially valuable elements of biodiversity;
 - Policies / strategies are to be developed to achieve the goals of our international obligations (under the Convention on Biological Diversity) and to design a comprehensive inventory of the biodiversity to be conserved and managed.
- The National Biodiversity Strategy and Action Plan (2000) had outlined the following critical and measurable objectives for biological diversity conservations. To date these remain very important since there is the need and urgency to:
- Provide broad-based support for conservation and sustainable use of biodiversity;
 - Develop sustained financial mechanisms to support biodiversity conservation and management.
- Use key tools e.g. Environment Impact Assessment (EIAs) in conservation and management of biodiversity.
 - Develop and implement an integrated approach to conservation and management of goods and services provided by ecosystems.
 - Protect key ecosystems from negative human induced impacts;
 - Develop and encourage sustainable utilization of biological resources that are essential to the livelihood of local communities;
 - Maintain, recover and promote genetic resources necessary for sustainable agriculture;
 - Ensure a fair and equitable sharing of the benefits arising out of the utilization of genetic and ecosystem resources and;
 - Provide information on key ecosystems for incorporation into national accounts and decisions on national development projects;
 - Design a coordinated and strategic approach to assessing and managing biodiversity and supporting research efforts;
 - Develop a systematic, long-term commitment to developing a national biodiversity inventory repository;
 - Ensure that there is an agreed national, systematic and standardised methods and protocols for describing, assessing and managing biodiversity including data entry and information management systems;
 - Build and improve on the taxonomic knowledge that exist with emphasis being placed on the declining human and institutional capacity in taxonomy;
 - Increase the emphasis being placed on traditional and local knowledge and information /data gathered by the private sector.

Activities such as creating awareness on biological diversity and conservation issues in Grenada, a national Land Use Policy for Grenada, mapping and strengthening the management of key ecosystems and biological pest control, revision and updating of existing legislation related to biodiversity conservation and the incorporation of ecosystem valuation into national accounting need to be addressed and taken into consideration in order to effectively address biodiversity issues. Capacity building for the conservation of genetic material and the promotion of sustainable use of genetic resources are critical issues to be considered when devising a national plan or policy that addresses biodiversity.

Strategic Planning for Biodiversity:

Grenada fully subscribes to the Strategic Plan for Biodiversity and the Aichi Targets. The implementation of the Strategic Plan is however conditioned on the existing socio-economic realities of the country. National capacity limitations including access to adequate levels of financial, human and technical resources have negatively impacted on implementation. In the main implementation is driven by the availability of external resources.

In light of limited resources, Grenada selected ten of the twenty Aichi Target to focus its available resources for implementation. It is envisaged that through a series of national and regional initiatives that Grenada will make substantial progress on the implementation of these targets.

It is also envisaged that while implementation coordination will be centralized in the public sector through the Environment Division of the Ministry of Agriculture, Lands, Forestry and the Environment, that national implementation mechanisms will of necessity provide for active participation of the private sector, civil society organisations and local and community groups. While a sectoral approach is currently being used, efforts towards an integrated approach and mainstreaming are inevitable.

It is expected that all sectors will be involved in a holistic and coordinated manner and the direct linkages between biodiversity conservation and enhanced livelihood and wellbeing will be the driver for enhanced implementation.

The key implementation issues for the prioritized targets are as follows:

- Broad understanding required of intrinsic value of biodiversity valuation studies completed for mangroves and parks and protected areas.
- Low level knowledge and improper attitudes to biodiversity conservation.
- Recognition of synergies among complementary objectives.
- Comprehensive education programme organized around community development sustainable livelihoods, leadership and advocacy and applied demonstration.
- Capacity building for farmers, fishermen and community leaders in soil and water conservation practices linked to biodiversity conservation and food and nutrition security.

- A need to strengthen institutional capacity.
- Appreciation of the importance of biodiversity conservation on decision making level to national development, attainment of macroeconomic goals and social development goals.
- Leadership within the public sector to commit to and implement conservation goals amidst other challenges.
- Human resources assigned to coordinate implementation.
- Institutional arrangements and indicators for monitoring implementation.
- Strategic focus on financial resource mobilization for biodiversity conservation.
- Biodiversity as natural heritage and source of ecosystem goods and services.
- Lessons learnt for successful initiatives like draft land use policy for Carriacou.
- Sustainable agriculture and fishing practices.
- Biodiversity demonstration projects with adoption plan and replication mechanisms.
- Protected areas designated and effectively managed.
- Collaboration mechanisms among various stakeholders.
- Gaps in policy, legislative and governance frameworks,
- Capacity needed to address climate change and invasive alien species.
- Development of indicators.
- Prioritization of research and development
- Resource mobilization capacity enhancement.
- Enhanced budgetary allocation for conservation

It is generally agreed while implementation of the Aichi Targets depends on accessing external support that more aggressive strategic efforts on the national level

are needed. Political will and leadership were deemed to be critical elements of a more aggressive and strategic effort.

Lessons Learnt:

The major lessons learnt from the implementation of the Convention in Grenada include the following:

- Political leadership and commitment to biodiversity conservation is necessary.
- Direct linkages between biodiversity conservation and improved livelihood and wellbeing are critical for "buy-in" and ownership for behavioral change to move sustainable production and consumption patterns.
- A recognition that improved macroeconomic and social development conditions directly depend upon biodiversity conservation and effective management.
- There is a need to focus on the direct and indirect drivers of biodiversity loss.
- It is imperative to engender full participation and involvement of all major stakeholders including public, private, civil society and local communities in biodiversity decision making.
- While sectoral approaches are most convenient there is the need to foster collaboration integration and holistic approaches on the national level.
- The necessary institutional structures must be in place with the human resources, financial and technical capacities.
- With the focus on implementation a comprehensive and sustained public education and awareness programme is an imperative.
- There is great importance and utility in adopting regional approaches to biodiversity conservation and management.

INTRODUCTION

I.1 Background

Grenada ratified the Convention on Biological Diversity (CBD) on August 11, 1994. In keeping with its obligations under Article 26 of the Convention Grenada has previously submitted four (4) national reports. This document constitutes the Fifth National Report to the Convention prepared pursuant to decision x/10 of the Conference of the Parties.

The Fifth National Report has been completed in parallel with the review and updating of the National Biodiversity Strategy and Action Plan (NBSAP) and in accordance with the published document entitled “Guidelines for the Fifth National Report” which was agreed by the Parties to the Convention. The report benefitted tremendously from a series of national consultations and from the outcome of the Regional Workshop for the Caribbean Countries on the preparation of the Fifth National Report held in September 2013.

As indicated in the foregoing mentioned guideline document, this report is supplementary to the previous reports, thus focusing on developments since the last national report including progress achieved towards the Aichi Biodiversity Targets.

I.2 Structure of the Report

In accordance with the guidelines the report has three main parts as follows:

- Part I: Overview of Biodiversity Status, Trends and Threats and Implications for Human Well-being
- Part II: National Biodiversity Strategy and Action Plan Implementation and Mainstreaming of Biodiversity
- Part III: Progress Towards the 2020 Aichi Biodiversity Targets and the Relevant 2015 Targets of the Millennium Development Goals



Map of Grenada

PART I

2.0 OVERVIEW OF BIODIVERSITY STATUS, TRENDS AND THREATS AND IMPLICATIONS FOR HUMAN WELL-BEING:

2.1 General Characteristics:

The Grenadian Economy

The Grenadian economy can best be described as a fairly diversified economy dominated by the services sector, which currently constitutes about 80 per cent of the gross domestic product (MOF, 2012). The recent global crises along with weather-related events and crises in the insurance and banking sectors have had a significantly negative impact on the economy. The economy went into a deep recession in 2009 and 2010, with negative annual growth rates of 5.6 per cent and 2.0 per cent respectively. The economy achieved a modestly positive growth rate of 1.4 per cent in 2011; -0.7 per cent in 2012; 1.3 percent in 2013, and for 2014 a 1.5 per cent growth rate was projected (MOF, 2011 and MOF 2013).

The Grenadian economy continues to face major challenges, including rising debt and debt servicing, stubbornly high unemployment rates and debt to GDP ratios, rising food and fuel prices, high food and fuel import bills, reduced foreign direct investments and remittances, challenges in the insurance and banking sectors, deteriorating physical infrastructure and reduced capacity to address socio-economic and infrastructure decline (ECCB, 2012). The national responses proposed to address these issues were to engage in

activities to maintain fiscal discipline and macroeconomic stability and to promote growth and to strengthen the national implementation capacity (MOF, 2012). In this regard, in 2012, the Government of Grenada identified five transformational sectors to re-energise the economy which constituted the sectors with the greatest potential to contribute to the economic transformation of the country.

The identified sectors are as follows:

- tourism and hospitality;
- health, wellness and education;
- sustainable (green) energy;
- agro business; and
- information communication technology (MOF, 2012).

In 2013, following the national elections the new government intensified negotiations with the International Monetary Fund and subsequently embarked on a comprehensive home-grown structural adjustment programme for the period 2014-2017 as part of the policy thrust of creating a new economy. The programme included fiscal adjustments and structural reforms including debt management, to boost economic growth, job creation and improved livelihoods. The policy thrust is dubbed the new economy. The objectives of which are summarized in Table I below and the key elements are listed in Box I.

Table I: Objectives of New Economy

	Objectives	Indicators
Growth and Job Creation	<ul style="list-style-type: none"> – Structural Reforms – Investments through Core PSIP – Increased support for small businesses – Citizenship by Investment Programme 	<ul style="list-style-type: none"> – Higher economic growth – Lower youth unemployment rate – Improved Doing Business Rank
Fiscal Sustainability	<ul style="list-style-type: none"> – Revenue administration reforms – Civil service reforms – Public financial management reforms – Public enterprise reforms 	<ul style="list-style-type: none"> – Increased tax effort – Reduced non-personnel expenditure – Monthly current expenditure in line with current revenue
Debt Sustainability	<ul style="list-style-type: none"> – Fiscal Consolidation – Debt Restructuring 	<ul style="list-style-type: none"> – Lower interest payments as a proportion of revenue and GDP – Reduced public sector debt as percentage of GDP

Box I: Elements of the New Economy

2013 Budget Statement

The key elements of the New Economy may be summarized as follows:

1. Fiscal sustainability (fiscal house in order)
2. Debt sustainability
3. Lean government
4. Private sector as key driver
5. Technical and vocational education and training
6. Life-long learning and high-wage employment
7. Innovation and knowledge
8. ICT applied to all aspects of development
9. World class service industry especially in tourism
10. Green business, industries and lifestyles
11. Sustainable development
12. Developing agriculture along the value chain
13. Efficient light manufacturing sector
14. Dynamic export sectors
15. Lucrative oil, gas and renewable energy sectors

Social Sector

With a population of approximately 105,000, a life expectancy of 76 years, an education index of 0.779 and a gross national income per capita in PPP terms of 6.982, Grenada has a Human Development Index (HDI) of 748 and ranks 67 out of 187 countries evaluated in 2011 (UNDP, 2012). The per capita GDP/PPP in 2011 was estimated at US\$14,100 (World Bank, 2012). The latest Country Poverty Assessment Survey, which was completed in 2008, indicated that 37.7 per cent of the population were living below the poverty line. A further 14.6 per cent were classified as vulnerable, meaning that this group was at great risk of falling below the poverty line. The level of indigence was estimated at 2.4 per cent, indicating the percentage of the population that were consuming below the minimum accepted level of nutrition (GOG, 2008). Therefore, more than half of the population in the period leading up to 2008 was deemed to be at serious risk. The 1998 poverty assessment reported indicated a poverty rate of 32.1 per cent, thus poverty has intensified over the period 1998 to 2008. It is generally agreed that the poverty situation in Grenada has not improved since the 2008 survey.

The survey identified the following factors giving rise to the poverty levels.

- limited income arising from poor job opportunities;
- very few safety nets;
- insufficient social infrastructure in rural communities;

- poor physical infrastructure especially in rural communities;
- lack of organised groups at the community level; and
- inadequate human resource (GOG, 2008).

The survey also identified several conditions and problems affecting the poor, including:

- inability to purchase the basic necessities of life;
- lack of access to basic social amenities like clear water, quality housing, health assistance and education;
- high unemployment, low wages and heavy dependence on agriculture;
- lack of credit from financial institutions; and
- heavy dependence on remittances and government hand-outs (note that remittances were estimated to be the order of 25% of GDP in 2010).

The national response included the commissioning of several macroeconomic and sectoral strategies to address those concerns. The Growth and Poverty Reduction Strategy 2013-2018, for example, identified a series of measures to address the National Poverty condition.

In addition, the Non State Actors Panel prepared an Alternative Growth and Poverty Reduction Strategy, which took a slightly different perspective by focusing on the psychology of poverty, valuation of assets of the poor and on-the-ground solution-oriented outcomes (Non State Actors Panel, 2012).

Social conditions in Grenada have influenced the national approach to biodiversity conservation and environmental sustainability.

Biodiversity conservation as a means to alleviate the plight of the poor through practical community-based activities to enhance livelihoods and investments in the health, wellness and education sector was deemed necessary for economic and social transformation in Grenada.

Box 2: Growth and Poverty Reduction Strategy

“Our 2013-2018 Growth and Poverty Reduction Strategy responds to the challenges faced. It is an important consensus policy statement which signals the alignment of the priorities of our people with the resources required to address them. We elucidate two primary constraints " Pro growth" and the "New Economy" as the guiding premise for our actions and interventions at the macroeconomic, sector and institutional levels over the next five years.

The 2013-2018 GPRS will act as the framework through which the actions and interventions of my Government and our development partners can be situated to achieve the greatest impact, while providing a benchmark for continuous monitoring and evaluation of the effectiveness of our actions in addressing the challenges of job creation, poverty reduction and economic growth.”

Source: Adopted from statement of Prime Minister and Minister of Finance, Dr. Keith C. Mitchell in Grenada Economic Transportation and Poverty Reduction Strategy 2013-2018

Environmental issues

The impacts of climate change, loss of biodiversity and land degradation are viewed as the most important environmental issues facing Grenada and constitute the greatest threats to the economic well-being and livelihood of the population. The impacts of recent hurricanes and droughts are evident throughout the country. In 2004, Category 3 Hurricane Ivan brought damage to the country to the tune of over 200 per cent of the GDP. One year later, Hurricane Emily, a Category 1 hurricane, struck and again set back the economy. Grenada experienced its most severe drought in 2009-2010. The rainfall deficit in 2009 and 2010 was estimated at 50 per cent and 80 per cent respectively (MOA, 2009). Grenada's environmental profile remains very fragile and vulnerable to external shocks.

In response, Grenada has embarked on several strategic and sector-based initiatives to enhance the national capacity and resilience to cope with these events and phenomena. The initiatives include the elaboration of the National Biodiversity Strategy and Action Plan, the National Capacity Self-Assessment, the National Climate Change Policy, the Pilot Program on Climate Resilience, the Sustainable Land Management Policy, the National Hazard Mitigation Policy and the National Environmental Management Policy, Strategy and Action Plan.

2.2 Summary of Grenada's Biodiversity:

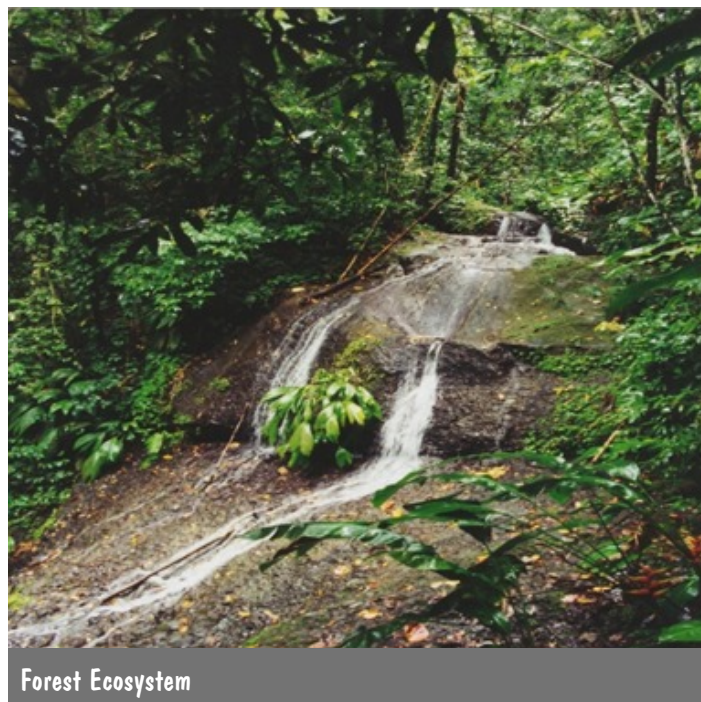
Despite its small size, Grenada possesses a relatively high degree of biodiversity which is essential to the provision of ecosystem goods and services. This section will provide a brief synopsis of Grenada's Biodiversity in particular the status and trends, major threats and attendant implications for livelihood. The section looks through the lenses of forest biodiversity, freshwater biodiversity, coastal and marine biodiversity and agriculture biodiversity. The section concludes with an examination of the impact of climate change on biodiversity. The nexus of climate change and biodiversity issues were not included in previous reports to the Convention.

2.2.1 Forest Biodiversity

Status and Trends

Forest types

The majority of Grenada's biodiversity is found in its forests. The most comprehensive assessment of Grenada's forest resources was documented by Beard in the 1940's. Beard's classification included six (6) forest communities: cloud forest; rain forests and lower montane rain forest; evergreen and semi-evergreen seasonal forest; deciduous forest and dry woodlands; littoral woodland; and mangrove forest.



Forest Ecosystem

The major forest regions in Grenada are found at Mt. St Catherine, Grand Etang Forest Reserve, Mt. Hope/Claybony water catchment (private lands), Levera, Morne Delice, the Annandale watershed, and High North Forest Reserve in Carriacou.

Wild life

Grenada's terrestrial wildlife consists of 4 amphibian species. The Grenada Whistling Frog (*Eleutherodactylus euphonides*) is endemic to Grenada and is among the most vulnerable in the West Indies (Henderson and Berg, 2011). There are 8 species of lizard and 5 species of snake (one endemic).



Monkeys (*Cercopithecus mona denti*)



Manicou (*Didelphis Marsupialis Insularis*)

There are 150 species of birds (18 of which are deemed to be threatened or endangered), 4 native species of terrestrial mammals and 11 native species of bats. Monkeys (*Cercopithecus mona denti*), the manicou (*Didelphis marsupialis insularis*), the armadillo (*Dasypus novemcinctus hoplites*), the ramier pigeon (*Columba squamosa*) and iguana (*Iguana iguana*) are the main hunted species.



Iguana

Plant species

McGregor et al (1998) reported 450 species of flowering plants and 85 different types of trees in Grenada. Recent data pointed to approximately 1,068 vascular plants (Caribsave, 2012).

Very little formal documentation exists on the composition and status of Grenada's forests resources. However, four (4) endemic plant species were documented by Hawthorne et al (2004), namely the Grenadian Gouti Tree (*Maytenus grenadensis*), the Grenadian Towel Plant (*Rhytidophyllum caribaeum*), *Lonchocarpus broadwayi*, and *Cyathea elliotti*.





Coleus Aromaticus

Considered almost endemic to Grenada, and found on less than three nearby islands are seventeen (17) species including Damsel (*Phyllanthus acidus*) and Mountain Cabbage (*Euterpe dominicana*), a slender palm found only on mountain ranges (Hawthorne et al, 2004).

No references are made about threatened or endangered plant species in Grenada, and none are listed in the International Union for Conservation of Nature (IUCN) Red List of threatened species.

Birds

Grenada's resident birds include two endemics, the critically endangered Grenada Dove (*Leptotilla wellsi*) and the Grenada Hook-billed Kite (*Chondrohierax uncinatus murus*) listed as endangered in the IUCN Red List.

Four species of birds which are endemic to the Lesser Antilles are also found in Grenada. The Grenadafly-catcher (*Myiarchus nugatory*), the Scaly-breasted



Hook-billed Kite (*Chondrohierax uncinatus murus*)

Thrasher (*Margarops fuscus*), the Lesser Antillian Bullfinch (*Loxigilla noctis*), and the Lesser Antillian Tanager (Tanager (*Tangara cucullata*).

Mammals

Approximately 22 species of terrestrial mammals are found in Grenada (Troy, 2012). Three of these species are native, -the Lesser Chapman's Murine Opossum, the Greater Chapman Murine Opossum and the Nine Banded Armadillo.

Twenty percent (20%) of all terrestrial mammals are bats, characterized as Keystone Species.



Armadillo (Tatou) (*Dasypus Novemcintus Hoplites*)

Invertebrates

Invertebrates as a group are well represented on Grenada. However, further ecological surveys are required to determine the true status of invertebrate species on the island.

Loss of Endemics

During the period 2001 to present, significant changes were documented in species abundance for two of Grenada's endemic animals, the critically endangered Grenada Dove and the endangered Grenada Frog. The latter is now threatened by the globally challenging *Batrachochytrium dendrobatidis* fungal infection detected in 2009, and competition from the invasive Johnstone Frog (*Eleutherodactylus johnstonei*) (Berg, 2011).

The more well known of these two endemics, the Grenada Dove, created international headlines during the reporting period on account of international concerns over habitat conversion for tourism development. Box 3 provides a direct reference to this case and summarizes an important example regarding positive outcomes between development and dove conservation in Grenada.

The most recent Grenada Dove census conducted in 2007 (Rusk, 2008) revealed that sixty eight (68) confirmed territorial males or a total population of 136 doves assuming a sex ratio of 1:1. The census indicated an overall decline in the population of the Grenada Dove from 91 territorial males pre-Ivan to 68 territorial

males in 2007. Over 47% of all Grenada Dove were located on or immediately adjacent to the Mt. Hartman Estate.

Box 3: Case Study - Mt Hartman Development and the Grenada Dove: Finding a Win-Win Solution

In 2006, a Four Seasons Resort developed by Cinnamon 88 was proposed to be built in the Mt. Hartman's Estate, the most important habitat for the Grenada Dove. This generated major outcry from the local, regional and international scientific community and community based advocacy groups. The conflict centered around loss of critical habitat for the Grenada Dove, and Government's ability to sell national park lands authorized through an amendment to the National Parks and Protected Areas Act 1990. This controversy according to Rusk represented a turning point in the dove story, which could have either become a textbook example of how conservation and development worked together to achieve compatible goals or a tragic story about how development overran yet another endangered species' critical habitat and caused its extinction.

Through informal negotiations coordinated by the Prime Minister's office, Dove Specialist Bonnie Rusk worked with Cinnamon 88, Forestry Officials and the international scientific community to find a solution. Despite the challenging process, research undertaken by Rusk provided a solid scientific basis to guide the future thrust of the resort's development.

Cinnamon 88 incorporated recommendations from dove specialist, voiced support for dove conservation outside the estate, financed the Grenada Dove census and development of a revised draft Conservation and Recovery Plan for the Grenada Dove (Rusk, 2010).

More than half of the doves were located on private lands (54.4%)¹, followed by the proposed protected area at Mt. Hartman (36.8%) and unprotected crown lands at Beausejour (4.4%). Less than 5% of the birds were sited at Perseverance Protected Area, a legally designated zone. Rusk (2008) cautioned that continuation of this status quo characterized by a perilously small population in a stagnant area of habitat has little chance of success. Protection of current habitats and expansion of habitats outside Mt. Hartman and Perseverance are therefore critical.

In 2014, the Grenada Dove continues to be threatened by intense pressure on its habitat largely from physical development, invasive species and climate change. Rusk posits, "Predation by invasive species primarily mongoose, rats and possibly feral (wild) cats is without a doubt causing a reduction in the Grenada Dove population.

This case amplifies the tension which exists in Grenada between biodiversity conservation and development.



Grenada Dove (*Leptotila Wellsi*)

¹ A total of 37 territorial males sited on private lands (Mt Hartman Development 4; Woodford 8; Beausejour private portion 7; Petite Bouc/North of Woodlands and Mt Hartman 19).

Major Threats and Implications for Human Wellbeing

The main threats that forest biodiversity faces therefore include the clearing of the land for agricultural production and tourism development, animal tethering, housing settlements, infrastructure and commercial activities. Additionally, forest biodiversity is also threatened by natural disasters, including hurricanes, forest fires and pest infestation.

Grenada's wildlife species face habitat destruction, unsustainable extraction and bad hunting practices. The main reasons for these threats include lack of or limited public education, limited enforcement and monitoring, lack of adequate legislation and invasive alien species

Grenada's forest communities were severely affected by Hurricane Ivan, with intense impairment to asset functioning. Most terrestrial forest ecosystems are currently in a recovery phase dominated by secondary forest with pockets of climax forest.

Forest officials reported over 50% restoration of mangrove communities particularly on mainland Grenada stimulated by planned restoration coordinated by the Grenada Fund for Conservation and other entities. Mangrove forests however, are at risk due to the impacts of land development activities, for instance the Tyrell Bay Marina in Carriacou located within the Sandy

Island Oyster Bed Marine Protected Area (MPA)² The latter types of developments have stimulated public clamour due to the ecological and socio-economic importance of the resource.

A significant portion of Grenada's population depends



on the forest ecosystem for goods and services as their main source of income. Several communities

are located within and in close proximity of the forested areas given the small size of the country. The forests support the livelihood of these communities.



Honey



Building made of Bamboo

² Awaiting official legal designation.

2.2.2 Fresh Water Biodiversity

Status and Trends

In terms of freshwater resources, there are many rivers, streams and lakes on the main island of Grenada, which is in marked contrast to Carriacou and Petite Martinique, where no permanent freshwater streams exist. Grenada's watershed regime comprises a system of forested protected areas and national parks. The freshwater ecosystem of Grenada, Carriacou and Petite Martinique includes the following:

- Three main volcanic lakes (Grand Etang, Levera and Antoine);
- One man-made lake (Palmiste);
- Several surface water streams including an intricate network of rivers;
- A small number of springs

In terms of biodiversity, there are 17 freshwater species on mainland Grenada. The most significant freshwater fish species are yoca, titiree, crevalle jack, mullet, crayfish, zandmey, river coco, tilapia, guppy and sword tail. A wide variety of snails and insects is also present, as is



River - Calivigny, St. George

freshwater shrimp. While there are no studies available on the status of these species anecdotal evidence gleaned from the interviews with government officials and the rural communities spokespersons suggest that these species are in decline.



River - Bylands, St. Andrew

Major Threats and Implications for Human Wellbeing

Grenada's freshwater ecosystems suffer primarily from improper domestic solid waste and liquid disposal, overexploitation of species, unsustainable agricultural practices (including the use of weedicides and pesticides), saline intrusion, deforestation, and introduction of alien invasive species and extensive use of freshwater for domestic and commercial purposes.

The freshwater ecosystems are critical for Grenada's water supply and food security. The fresh water resources are the bed rock for the tourism and agriculture sectors and constitutes the main source of livelihood for the citizens of the country.

2.2.3 Coastal and Marine Biodiversity

Status and Trends

Marine species

Grenada has 233 marine species, 69 marine/brackish water species, and several species of sea birds (GoG, 2009). Four turtle species nest on select beaches, namely the Green Turtle (*Chelonia mydas*), Loggerhead (*Caretta caretta*), Hawksbill (*Eretmochelys imbricata*), and the Leatherback (*Dermochelys coriacea*) (GoG, 2009). The Kemp's Ridley and Olive Ridley turtle species have also been sighted and are known to visit on the out islands. The hump back whales are observed on a seasonal basis (GoG, 2009).

Coral reefs

Grenada's coral reef cover was 12.5 square kilometers (GOG 2009). The coral species found in Grenada have been assessed under the protocol of IUCN Red List of Threatened Species. Eleven species were red listed and two species (Staghorn and Elkhorn Corals) were designated critically endangered (IUCN, 2013).

There are 317 coral reef associated fish species. 81 of these were assessed under the IUCN Red List Protocol and 23 species were red listed (IUCN, 2013).

Surveys completed between 2008 and 2010 revealed that there was a significant decrease in the major groups (Anderson et al, 2012). Sharks, groupers and rays were assessed as endangered or threatened.

The invasive lion fish (*Pteros volitans*) was a key factor in the decline of reef fish stock.

Mangroves

The total mangrove cover for Grenada is 284 hectares with 172 hectares in mainland and 112 hectares in Carriacou (Helmer et al and Spalding et al 2010). Mangrove cover was estimated to decline between 1980 and 2005 by 1.2 to 1.5 percent (FAO, 2007).

Five endemic mangrove species have been identified in the mangal flora of Grenada.



Mangrove - Fort Juedy, St. George

These species deemed to be threatened include two species of black mangrove, silver leaved button wood, white mangrove and red mangrove (Polidoro et al 2010 and Lambert et al 2010).

Sea grass beds

The sea grass bed cover in Grenada is estimated at 1800 hectares (Aucion, 2013). Six sea grass species are identified with the sea grass ecosystem in Grenada. These include the turtle grass (the most common species) manatee grass, shoal grass, paddle grass, halophis sea grass and cover grass (Willette and Ambrose, 2009).

These species are concentrated along the eastern and south eastern coast of Grenada and the eastern and south eastern coast of Carriacou (Nayeretal, 2009). The rate of decline in coverage of sea grass is increasing (Walcott et al, 2009) but five of the six species are considered to be least concern while one species (cover grass) is considered as vulnerable (Litter and Litter, 2000).

Major Threats and Implications for Human Wellbeing

Grenada's marine and coastal ecosystems are overexploited, overused and in some instances destroyed. Commercial species are overexploited. There is overuse of the coastal ecosystems for agricultural, energy, tourism and construction purposes. Beach sand mining, pollution through dumping of solid and liquid wastes, poaching and illegal extraction of resources, unsustainable agricultural farming and fisheries practices, habitat destruction and disturbances in the food chain and spillage of oil-based substances have been widely re-

ported as a main threat to the coastal and marine ecosystem.

The marine and coastal ecosystem of coral reefs, mangroves and sea grass beds provide spawning, hiding, recruitment and foraging habitats for assemblages of reef species, migrant pelagic and vagrant species. The common threats are identified as marina construction, villa residents and condos, nutrient loading, yacht anchorage, turbidity from land sourced sedimentation, agricultural run-off, sewage disposal and pollution, coastal sand mining and invasive alien species. The Orinoco green water is also credited for occasional major fish kill in Grenada.

Special mention must be made to the main invasive alien species affecting Grenada's marine and coastal ecosystem namely lion fish (*pterois volitaus*). The lion fish was sighted in Grenada waters in October 2011. The species is considered to be especially threatening because of its high fecundity, its short life cycle, its apparent isolation from known predators and its wide diet-breadth.

As indicated the Grenadian economy is dominated by services primarily in the tourism sector. The marine and coastal ecosystem accounts for a major portion of the country's gross domestic product.

2.2.4 Agriculture

Status and Trends

Land Use Systems Change

Land use change and transformation are generally accepted as key drivers of biodiversity loss (Haines Young, 2009). Researchers posit that by 2100, the impact of land use change on biodiversity is likely to be more significant than climate change, nitrogen deposition and species introductions (Chapin et al, 2000 & Sala et al, 2000 as quoted in Haines-Young, 2009). An analysis of the land use system change for Grenada for the period 2000 and 2009 is illustrated in Figure 1. Main findings are summarized below:

Abandoned cropland reported the most significant land use change between the two periods; 356 acres (1.14%) in 2000 compared to 6,122.15 acres (19.54%) in 2009, equivalent to 1614% increase. Official cited

decline in the agriculture sector as the principal reason for this trend.

Additional analysis indicated that the total land area used for agriculture declined by 35.5% over the nine year period; 44,929 acres (58%) in 2000 compared to 28,952 acres (37.4%) in 2009.

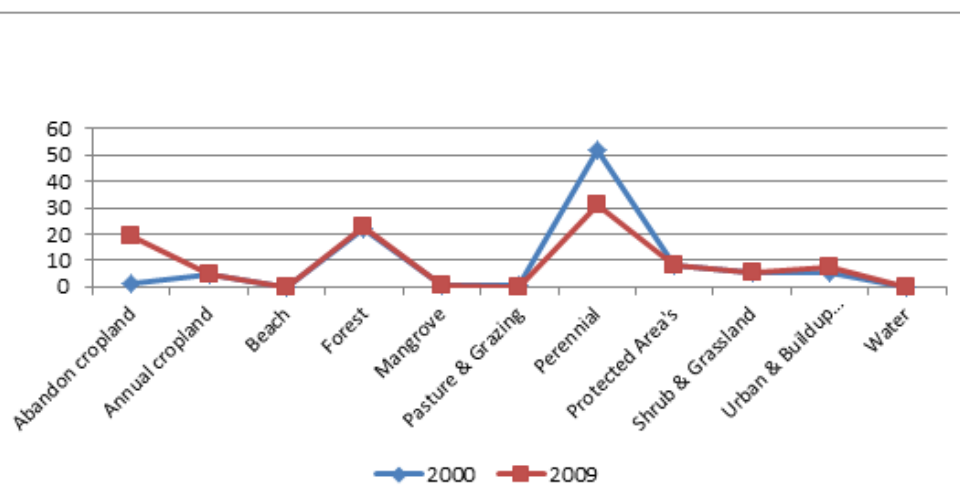
Land under perennial production decreased drastically by 40.35%, from 16,282 acres (51.93%) in 2000 to 9,707.08 acres (30.98%) in 2009.

Though less dramatic, land characterized as urban and buildup areas enlarged from 1,825 acres (5.82%) to 2,266.72 acres (7.23%), equivalent to 24.23% increase.

Negligible changes were documented in beach, mangrove, pasture and grazing. Protected areas increased in the period understudy.

Figure 1: Land use system change Grenada, 2000 & 2009

(Land Use Division, 2014)



Land Use Intensification

The Physical Planning Unit (PPU) reported that land subdivision (particularly within inland areas) represented the most intensive land development change during the period post 2000.³ Officials from the Land Use Department confirmed that non-agriculture land uses have intensified considerably, particularly with respect to urban and suburban residential development in both mainland Grenada and Carriacou. This has resulted in serious encroachment on prime agriculture lands, and is a cause for concern for the Ministry with responsibility of Agriculture, since it presents a challenge in the context of national food security (Dottin, 2009; Lewis,

2014). Officials speculate that this trend will likely continue in the absence of a National Land Use Policy that seeks to sustainably manage land utilization (Dottin, 2009), and the projected medium to long term housing needs.⁴

An analysis of population trends in the State of Grenada from 1971 to present revealed a general increase in population growth in urban centers as illustrated in Figure 2.3 (Enoe, 2014). The impact of this growth on critical coastal ecosystems, and the potential for increase runoff into aquatic and marine systems require further analysis.

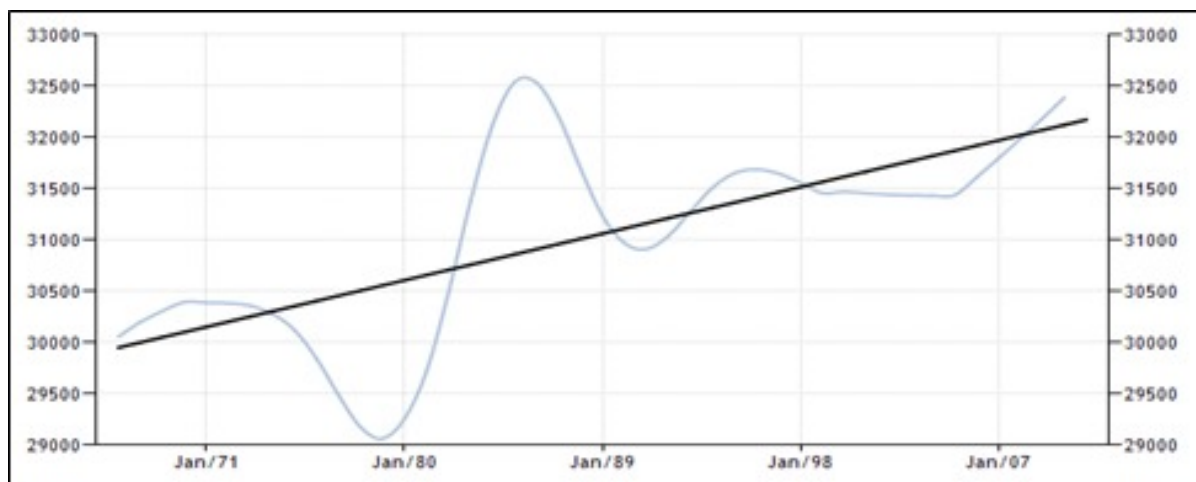


Figure 2: Urbanization trends in Grenada, 1971 to 2012 (Enoe, 2014)

³ Detail information documenting subdivision trends were unavailable during the time of this research.

⁴ At least 63 acres of land are projected to meet housing demands, 2001-2011 (Williams, 2003).

Land Use, Land Degradation and Biodiversity

Implementation of the Land Degradation Assessment for Dry lands (LADA) project in 2012 revealed the following findings with implications for biodiversity conservation.

- Biological degradation, chiefly increase in pests within perennial and underutilized cropland, and reduction in vegetative cover within forested areas represented the most dominant types of land degradation, followed by loss of top soil in urban and built up areas and farmlands.
- To a lesser extent, chemical soil deterioration due to fertility decline and reduced organic matter content were observed in annual croplands in select areas.
- Generally land degradation is reported to be slowly increasing throughout 75% of mainland Grenada. Moderate increase in land degradation is reported in about 20% of the island, predominating mostly along the northern coastal.

Major Threats and Implications for Human Wellbeing

Grenada faces many challenges in managing its rich natural resources. Population growth, infrastructural development, as well as unsustainable global, regional and local production and consumption patterns, drive the increasing demand for, and extraction of raw materials and other natural capital as well as destruction of

natural resources. This has led to the extensive conversion of natural environments to generally unsustainable productive systems, resulting in drastic impacts on Grenada's biodiversity.

Agricultural biodiversity's challenges are in the ever-changing land use and loss of vegetated lands. This also creates conditions for soil erosion and siltation of rivers and coral reefs. This can result in a loss in habitat for wildlife and reduction in flora and fauna. There is also a decline in the use of traditional crops and domesticated animals in Grenada. In addition there is also the threat of genetically modified organisms (GMOs) that can cause genetic erosion if they escape into the wild. Other threats include the impact of natural disasters, especially tropical storms and hurricanes, the increasing use of pesticides and insecticides, the introduction of invasive alien species and pest infestation.

Biodiversity in agricultural landscapes depends largely on the intensity of land use as measured by input variables such as chemical fertilizer, pesticide use and ploughing frequency (Reidsma et al, 2006). Petit et al (2001) posits that agricultural intensification would become the most important pressure on biodiversity in the coming decades.

Officials within the Ministry of Agriculture reported that while agrochemical dependent vegetable and root crop production increased within the last decade, the practice of agriculture became less intensive. This they apprise is linked to reduced importation of ecosystem damaging pesticides by the Pesticide Control Board, decline in fertilizer use correlating to higher prices, and the continued demise of the banana industry. The use of brushcutters and trimmers⁵ increased substantially at the farm level, a likely indicator of diminishing reliance on herbicides.

Livestock production on the contrary became increasingly intensive post 2000 due to reduction in available lands, fueled by a heightened focus on a growing real estate industry and associated increase in physical development. In Carriacou, the culturally enshrined "leggo season" is less evident. Generally, livestock is currently managed using a smaller land area, with increase input intensity.

Although technicians and some resource users agree that agricultural activities negatively impact ecosystem health at the site and landscape levels, very little credible data is available to corroborate this perspective. A recent study however, conducted in 2013 to assess the impact of discharges emanating from the Beausejour and other nearby rivers on coral reefs in the Moliniere

Beausejour Marine Protected Area (MBMPA) pointed to agriculture as a major underlying cause of pollution.

2.2.5 Impact of Climate Change on Biodiversity

Climate impact is identified as one of the key drivers of bio diversity loss in Grenada during the period of study. A substantial section of this report is devoted to the issue of climate change as this was never covered in previous reports to the Convention. In addition, Grenada's biodiversity has been significantly impacted by climate related events over the last decade.

The Government of Grenada has not developed or adopted a specific climate change scenario for Grenada. However, modeling done for the UNDP Climate Change Country Profiles⁶ have reported observed climate change for Grenada, as follows:

- Temperature increases - Mean annual temperature in Grenada has increased by around 0.6°C since 1960, at an average rate of 0.14°C per decade.
- Precipitation changes - Mean rainfall over Grenada has increased in September, October and November by 12.0 per month (6.3%) per decade since 1960, but this increase is not statistically significant. This increase is offset partially by decreases of around 4.5mm per month (2.5%) per decade in June, July and August.

The UNDP Climate Change Country Profiles also developed projections of future climate change for Grenada and concluded as follows:

⁵ Commonly referred to as weedeaters.

⁶ UNDP Climate Change Country Profiles, Grenada. C. McSweeney1, M. New1,2 and G. Lizcano1

- Mean Surface Temperature increases - The mean annual temperature is projected to increase by 0.7 to 2.6°C by the 2060s, and 1.1 to 4.3 degrees by the 2090s. All projections indicate substantial increases in the frequency of days and nights that are considered 'hot' in current climate.
- Precipitation - Projections of mean annual rainfall from different models in the ensemble are broadly consistent in indicating decreases in rainfall for Grenada. Ensemble median changes for all seasons are negative. Annual projections vary between -61 and +23% by the 2090s, with ensemble median changes -13 to -21%.
- Sea Level Rise - The Country Profile states that the Caribbean islands are vulnerable to sea level rise. Sea level in this region is projected by climate models to rise between 0.13 and 0.56m by the 2090s, relative to 1980-1999 sea-level.

The Country Profiles did not report on other parameters specifically for Grenada, although it did provide general guidance on sea level rise for the region, viz:

- Sea Level Rise - The Country Profile states that the Caribbean islands are vulnerable to sea level rise. Sea level in this region is projected by climate models to rise between 0.13 and 0.56m by the 2090s, relative to 1980-1999 sea-level.



Terrestrial Biodiversity

Vegetation

The literature on Grenada's biodiversity contains information on the sensitivity of the forest vegetation to rainfall levels, highlighting inter alia that:

- Cloud Forests exist in areas where the precipitation is above 4,000 mm per year and relative humidity and exposure increases.⁷
- Rain Forests and Lower Montane Rain Forests occur below the cloud forests where rainfall exceeds 2,500 mm per year, temperature higher and exposure less than above.⁸
- Evergreen and semi-evergreen forests are found in areas where rainfall averages 2,000 mm - 2,500 mm per year.⁹
- Remnants of deciduous forests and thorn woodlands occupy the lower elevations. Rainfall in these areas range from 1000 mm to 2000 mm per year for five months

This direct relationship between rainfall levels and types of vegetation imply



that there is a possibility that the range of these different forest types could change and possibly migrate to higher elevations, in the event of reduced rainfall as projected by the climate change scenario.

⁷ Augustus Thomas (2005). *Overview Of Biodiversity In Grenada*.

⁸ *Ibid*

⁹ *Ibid*

A number of internal reports exist on Grenada's terrestrial biodiversity, but none of them specifically address the question of impacts of climate-related stressors like temperature and rainfall.

There are internal reports on the impact of hurricane Ivan in 2004, with several references to the extensive damage to the forest vegetation caused by the hurricane. Thomas described the event as causing "*considerable damage to the rain forests, uprooting, breaking and wounding almost about 90% of the trees*"¹⁰. This was supported by an assessment done by the Forestry and National Parks Department which concluded that "*A large proportion of trees, varying by Parish, were blown over and those that remain standing lost most of their branches ... Photographs of Grand Etang immediately after the hurricane showed, what appeared to be a mass of scattered brown 'sticks', some upright, but not a leaf visible anywhere. There was hardly a tree on the island that was not badly damaged, particularly in the southern two-thirds of the main island and in the more exposed section.*"¹¹

The forest vegetation is also susceptible to wildfire damage which occurs during the dry season. The available data from the Fire Department of the Royal Grenada Police Force provided comprehensive national information for 2007, 2008 and 2010 and showed that

acreage lost to forest fires during these years were 495 acres, 567 acres and 481 acres respectively. The Fire Department reported that all of these fires "resulted from human interaction with the environment" e.g. charcoal burning and slash burning by farmers, with the extreme dryness providing a facilitating environment.

Wildlife

There are limited references in the literature to Grenada's terrestrial wildlife, with only the Grenada Dove and some species of bats being cited. These references do not include information on climate related impacts and/or sensitivities.

Bonnie Rusk describes the importance of habitat to the Grenada Dove and states that "*Biologists that have studied the Grenada Dove agree that its status and distribution are closely tied to availability of suitable habitat (Rusk et al. 1998). The Grenada Dove is limited to patches of secondary coastal dry scrub woodland, remaining primarily in southwestern Grenada. Grenada Doves are also found in patches of scrub and moister seasonal forest remaining along the west coast. These habitats are predominantly secondary deciduous thorn-scrub woodland with emergent trees and leguminous vegetation. At these lower elevations rainfall varies from 100 - 200 cm during the 5-month rainy season*"¹².

¹⁰ Augustus Thomas (2005). *Overview Of Biodiversity In Grenada*.

¹¹ The Forestry and National Parks Department. 2005. *Vegetation and management issues in Grenada's forested uplands after Hurricane Ivan*.

¹² Bonnie Rusk. 2007. Grenada Dove (*Leptotila wellsi*) and the Mt. Hartman Estate, Grenada

Reductions in rainfall as projected by the climate change scenario could therefore negatively affect the availability of suitable habitats for the Grenada Dove.

Thomas cites the sensitivity of some species of bats to seasonal patterns and reports that for some species *"Births are timed to coincide with the rains/times when most food (flowers or fruit) is available ... The bat has two reproductive periods. The larger one coincides with peak fruit productions, (June-August) and the other with the blooming of flowers at the end of the dry season (Feb.-May) ... They will enter a state of torpor when food is lacking."*¹³

There are also reports that indicate that the wildlife has been adversely affected by hurricanes in a number of ways, viz:

- Reduction in Population - Many were killed during these extreme events and hurricane Janet in 1955 has been credited as giving *"the final push for the extinction of the agouti"*. It has also been credited with reducing the population of the African Mona monkey¹⁴. Hurricane Ivan also had an impact on the wildlife with Thomas reporting after the hurricane that *"The population status of these mammals since hurricane Ivan is unknown"*¹⁵.

This was supported by the results of a Census of the Grenada Dove done by Bonnie Rusk in 2007 which concluded that *"the total population decreased from 91 calling males immediately pre-Ivan to possibly as low as 32-60 post hurricane"*¹⁶. Rusk notes that *"the post Ivan (2004) population decline could be a result of mortality during the hurricane, mortality post-hurricane due to predation or lack of food resources, movement to other habitats (not searched), or difficulty detecting birds due to the noted decrease in territoriality and calling. Further population reduction may have resulted from a failed post-hurricane breeding season."*¹⁷

This type of impact was also supported by the report from the Forestry and National Parks Department which stated that *"It was reported that numerous birds just fell out of the sky after the hurricane, the impression being that they had died of shock or something similar."*¹⁸

¹³ Augustus Thomas (2005). Overview Of Biodiversity In Grenada

¹⁴ Augustus Thomas (2005). Overview Of Biodiversity In Grenada

¹⁵ Ibid

¹⁶ Bonnie Rusk. 2007. Grenada Dove (*Leptotila wellsi*) and the Mt. Hartman Estate, Grenada

¹⁷ Ibid

¹⁸ The Forestry and National Parks Department. 2005. Vegetation and management issues in Grenada's forested uplands after Hurricane Ivan

- **Habitat Damage**- Damage to habitats is another impact of extreme events, as evidenced by the experience of hurricane Ivan. Thomas reports that "Hurricane Ivan on September 7, 2004 caused significant damage to the Grenada Dove habitats at Mt. Hartman and Perseverance. Most of the damage included felled trees, broken limbs and branches and leaning trees. All trails and access roads have been blocked"¹⁹.



Grenada Dove (*Leptotila Wellsi*)

- **Reduction in Food Availability** - The report by the Forestry and National Parks Department cited food availability as another effect of hurricane Ivan citing the fact that "manicou were seen around roads and houses, desperate for food and, consequently, highly vulnerable to predation"²⁰.

This susceptibility of both the wildlife and its habitat to the impacts from extreme events is a cause for concern, in light of the projections in the climate change scenario for stronger, more intense hurricanes in the future.

Freshwater Biodiversity - Ecosystems and Species

Documented studies and reports on the freshwater ecosystems and species in Grenada were not available.

There is reference in the international scientific literature to the potential impacts of climate change on freshwater ecosystems²¹. These include impacts that are relevant to tropical countries like Grenada, viz:

- Freshwater lakes and their ecosystems are highly vulnerable to climate change. At very long time scales (greater than centennial) paleo records show that lakes have altered their shapes and distributions and have disappeared entirely, with the processes related to climate change as a result of the shifting dynamics among precipitation, evaporation and runoff.
- The rates of change of freshwater systems to climate will depend on the ability of freshwater species to "move across the landscape", i.e. will depend on the existence of dispersal corridors; these can be strongly altered by human activities.
- River ecosystems are particularly sensitive to changes in the quantity and timing of water flows, which are likely to change with climate change.
- Changes in river flows may be exacerbated by human efforts to retain water in reservoirs and irrigation channels.
- Abundance and species diversity of riverine fishes are particularly sensitive to these disturbances, since lower dry season water levels reduce the number of individuals able to spawn successfully and many fish species are adapted to spawn in synchrony with the flood pulse.

¹⁹ Augustus Thomas (2005). *Overview Of Biodiversity In Grenada*

²⁰ The Forestry and National Parks Department. 2005. *Vegetation and management issues in Grenada's forested uplands after Hurricane Ivan*

²¹ FAO Fisheries and Aquaculture Technical Paper #530. *Climate change implications for fisheries and aquaculture. Overview of current scientific knowledge*

There were no internal reports available on Grenada's freshwater ecosystems and species.

There have been anecdotal reports²² of declines in river flows especially during the dry season, to the extent that some rivers disappear for a few months. Other anecdotal reports indicated that some of the freshwater species were susceptible to flooding and drought. During periods of flooding, these species were washed downstream, sometimes into the salty water at the

mouth of the rivers. During periods of drought, the reduced water levels made it difficult for some of the species to survive.

The impacts on the freshwater species is an area that needs further study and monitoring, given the projections for (a) reduced rainfall which would impact on stream flow and (b) increased intensity of hurricanes which would result in periods of flooding.



Grand Etang Lake

²² Personnel from the Forestry and National Parks Department, February 2014;

Coastal and Marine Biodiversity

Grenada's coastline of 121 km is home to diverse marine and coastal ecosystems including mangrove swamps, coastal lagoons, beaches, sea grass beds and coral reefs. These coastal ecosystems provide a habitat for many different types of fish and other marine species.

Mangroves

The most recent mapping of Grenada's mangroves²³ identified a total of 298 ha of mangroves within the tri-island state of Grenada and the Grenadines. Most of these resources occur along the southern and eastern coasts on the main island of Grenada as well as three core areas distributed throughout Carriacou. Petit Martinique does not contain mangrove areas.

The main island of Grenada possesses the greatest extent of mangroves (181 ha), followed by Carriacou (106 ha), while the comparatively minute Grenadine islands cumulatively account for an additional 11 ha.

Mangrove forests of Grenada and the Grenadines include fringe (65 ha), basin (181 ha), scrub (8 ha), and riverine (1 ha) habitats, as well as littoral/back mangrove (42 ha) as defined herein (Figure 6). While basin habitats represented the largest total area, most of these communities were relatively small patches (<10 ha). Only five mapped contiguous basin areas were larger than 10 ha, whereas all other habitat types reflected comparably small patch size.

The review of the scientific literature indicates that mangroves are vulnerable to climate change impacts including coastal storms and sea level rise.²⁴

In their recent mapping study of Grenada's mangroves, Moore et. al. concludes that *"the country's existing fringe mangroves are vulnerable to climate change-induced impacts. The fringe habitats are exposed to direct storm impacts, while the steep topography and abundant coastal development often directly adjacent to them hinder opportunities for landward migration in response to erosion and predicted sea level rise. Further jeopardizing Grenada's mangroves, climate change is expected to alter existing coastal habitats, such as conversion of basin mangroves to fringe habitats as storm surges open barrier beaches, increasing tidal action and flood duration."*

They also cite the effects of incremental sea level rise and storm over wash which can lead to increased salinity within coastal ponds, backwaters, and estuaries. Each of these processes, acting alone or in concert, can greatly affect colonization by all mangrove species that occur in the region.



Mangrove - Woburn, St. George

²³ Gregg E. Moore, Ben F. Gilmer, and Steven R. Schill (2014) *Distribution of Mangrove Habitats of Grenada and the Grenadines*. *Journal of Coastal Research* In-Press.

²⁴ Ellison and Farnsworth, 1996; Valiela, Bowen, and York, 2001; Day, 2009; Farnsworth and Ellison, 1997; IPCC, 2007

The study by Moore et. al. notes the impact of hurricane Ivan in 2004 which resulted in most mangrove patches on these islands suffering impact, from defoliation to blow downs, is also noted. In some cases, entire areas of mangrove forests were completely leveled. The full extent of the damage is not known, as it was not quantified and documented.

Interviews with key stakeholders indicate "significant losses of mangroves" in the Pete Bacaye and Requin areas, due to increased salinity of the areas as a result of sea level rise and the increased sea surface temperatures.

There are also concerns that some species will die as a result of sea level rise as they will not be able to migrate fast enough.

Coastal Lagoons

A coastal lagoon is a "*shallow coastal water body separated from the ocean by a barrier, connected at least intermittently to the ocean by one or more restricted inlets*" (Kjerfve 1994). Grenada has 71 watersheds, each of which has a river that ends in a lagoon as it flows into the sea. Some of the river flows are seasonal and not all lagoons are present year round.

Coastal lagoons are areas of brackish water in constant interchange with the sea. The salinity changes according

to tidal flows. They are highly productive ecosystems and are important for reproduction of marine fishes and some freshwater species and for sediment filtering and settling. They contribute to the overall productivity of coastal waters by supporting a variety of habitats, including salt marshes, sea grasses, and mangroves.

The review of the scientific literature indicates that lagoons are vulnerable to climate change impacts including sea level rise, temperature increases, precipitation and storms.

- Sea Level Rise - Accelerated sea level increase is a particular threat to low-lying, shallow-gradient coastal ecosystems. Most barrier-lagoon systems respond naturally to sea level increase by migrating landward along undeveloped shorelines with gentle slopes. However, with accelerated sea level increase, landward retreat of barriers may not be rapid enough to prevent inundation. Hardened shorelines on developed coastlines impede this natural migration and increase the vulnerability of coastal structures to inundation and storm damage.

As lagoon barriers retreat landward, accelerated sea level increase will lead to steeper and narrower barrier profiles, shortening the length of existing inlets (Bird 1994) and increasing the rate of exchange with the ocean. This will likely increase the barriers' vulnerability to breaching and the lagoons' flushing rates. As lagoons are inundated by seawater, salinity will increase, possibly altering the species composition.

²⁵ Personnel from the Forestry and National Parks Department, the Ministry of the Environment and the Grenada Fund for Conservation

- Temperature - Changes in air temperature strongly influence the water temperature of slow-moving, shallow water bodies such as coastal lagoons. There is an absence of published, long-term data for water temperature in coastal lagoons. However, the shallow nature and low flushing rates of coastal lagoons indicate that water temperatures in lagoons will increase. In lagoons with high flushing rates, the influx of ocean water will interrupt stratification, causing the water column to mix. In restricted lagoons with low flushing rates and high nutrient inputs, temperature increases will increase the probability and severity of hypoxic events.
- Precipitation - Intense precipitation events would increase short-term freshwater inputs while locally decreasing salinity. Conversely, lower precipitation would reduce freshwater inputs and potentially result in higher salinity. Salinity would also be affected by changes in flushing rate, which may counteract the changes in freshwater inputs. The expected increase in the variability and intensity of precipitation events is therefore expected to produce increased variability, both spatially and temporally, in salinity and dissolved oxygen concentrations in coastal lagoons. Other effects of increased surface water inputs include the increased delivery of sediment and nutrients to lagoons. Increased nutrient inputs may accelerate the eutrophication of lagoons, especially those with low flushing rates. This increased turbidity will reduce light penetration and the photosynthetic activity of submerged aquatic vegetation, compounding the risk of eutrophication as nutrient dynamics are further altered. In addition, reduced light penetration can inhibit the feeding ability of visual predators.

- Storms - Storms affect lagoons through over wash events and by erosion from wind and waves.

There were no internal reports available on climate related impacts on Grenada's coastal lagoons.

Interviews with key stakeholders²⁶ point to instances where the increases in sea surface temperature has caused high algae growth, and low oxygen content of the water, resulting in significant "fish kills" in these areas.

There have also been reports of "fish kills" after storm surges, resulting from the changed chemical composition of the water during the storm surges.

Beaches

Beaches are gently sloping strips of land bordering the ocean or other bodies of land. They are formed by the action of waves, rivers, currents, tides, and wind and are usually covered by sand, gravel or rocks.²⁷



A review of the international scientific literature of the impacts of climate change on beaches²⁸ describes the impacts on beaches to be negative. These include:

²⁶ Personnel from the Fisheries Department and the Ministry of the Environment

²⁷ Paul E. Phillip: *Coastal Resources of Grenada: Beaches/Coastal Lagoons*

²⁸ <http://centerforoceansolutions.org>; <http://www.sandwatch.ca>

- Increased beach erosion from sea level rise and more intense cyclones;
- Effects of coral bleaching as sea surface temperatures increase;
- Increased stress on coral formations as a result of increasing ocean acidification;
- Increases stress on plants and animals inhabiting beaches as temperatures rise.

A study of beach erosion in Grenada conducted by Dr. Everson Peters²⁹ concluded that "...the long-term impact on Grenada's beaches due to natural weathering processes in combination with climate change and the related sea level rise is expected to be significant". The study reviewed earlier work on beach erosion and carried out estimates of beach loss due to sea level rise. Application of the Bruun rule to beach erosion analysis shows that for a 50 cm rise in sea level, up to 60% of Grenada's beaches would disappear in some areas. These beaches include Grand Anse, Morne Rouge, Harvey Vale and Paradise.

The beaches have also been affected by erosion and submergence due to sea level rise and storm surges - Hurricane Lenny (1999), Ivan (2004), Emily (2005)³⁰. In the past 25 years, Sandy Island on the west coast of Carriacou, has lost about 60% of its area, while small

sand banks that existed for hundreds of years between Carriacou and Petite Martinique have disappeared completely³¹.

Other observed impacts include salt water intrusion from sea level rise and reduction in sand deposited on the beach as a result of degradation of the coral reefs from human and climate-related stressors³².

Interviews with stakeholders³³ highlighted other climate-related impacts including:

- Increased sea surface temperatures could affect negatively affect the organisms that live in the beach e.g. copepods (sea cockroach); ghost crabs; land crabs; nesting turtles - high temperatures affect gender of offspring - high temp leads to females.
- Extreme events like hurricanes wash away the sand from the beaches and leave them denuded and bare.
- The possibility that increased ocean acidification could affect the white sands that characterise the beaches, as the acidification will deprive the reefs of its calcium content, which is the source of the white sandy deposits.



Beach Crab- Fort Juedy, St. George

²⁹ Everson J. Peters. *Beach Erosion in Grenada.2000. Contribution to CPACC Component 6: Coastal Vulnerability and Risk Assessment*

³⁰ Paul E. Phillip: *Coastal Resources of Grenada: Beaches/Coastal Lagoons*

³¹ Internal document, Ministry of the Environment, Grenada Coastal Management Issues

³² Paul E. Phillip: *Coastal Resources of Grenada: Beaches/Coastal Lagoons*

³³ Personnel from the Fisheries Unit and the Ministry of the Environment

Sea Grass Beds

Seagrasses are flowering plants that thrive in shallow oceanic and estuarine waters. They grow in the sand at the bottom of the sea and hold the sand together thus preventing erosion. They also sequester carbon dioxide and produce oxygen.

A review of the scientific literature indicates that natural disturbances such as storms and floods can cause adverse effects on sea grasses. Other potential threats from climate change include rising sea levels, changing tidal regimes, UV radiation damage, sediment hypoxia and anoxia, increases in sea temperatures and increased storm and flooding events³⁴.

There were no internal reports available on climate related impacts on Grenada's coastal lagoons.

Interviews with key stakeholders³⁵ highlighted other climate-related impacts including:

- Extreme events like hurricanes rip the sea grass from the ocean floor and dump them on the shore. Sea grass deposits are usually found onshore after storms.
- Sea level rise could negatively affect sea grass beds, as they depend on sunlight. The increasing height of the water could increase the depth that the sunlight has to penetrate to reach the sea grass beds and make photosynthesis more difficult.

- Ocean acidification - increased ph of the water could affect plant structure and reproduction.

Coral Reefs

Corals are microscopic polyps joined together to form Colonies. These polyps are protected by hard exoskeleton (in the case of Hard Coral) of calcium carbonate secreted by themselves. These millions of polyp form large colonies and together with the hard exoskeleton form the hard structures we call Coral Reefs. As the polyps die, more are born, which in turn secrete their hard exoskeleton resulting in the overall growth of the reef³⁶.

A review of the scientific literature indicate that coral reefs are vulnerable to climate change including impacts related to increasing temperatures, ocean acidification, storm intensity and sea level rise³⁷, viz:

- Temperatures - Corals generally thrive in warm tropical waters, between 18oC and 30oC. If the temperature rises beyond their threshold, corals often eject their zooxanthellae, some of which are pigmented - this phenomenon causes the coral to lose its color and is termed *bleaching*³⁸. ... bleaching also occurs if increases of 1.5C above current temp levels
- Ocean acidification - increasing acidification of the ocean will dissolve the coral.

³⁴ Mats Bjork^{1,2}, Fred Short³, Elizabeth Mcleod⁴ and Sven Beer^{5,2} *Managing Seagrasses For Resilience To Climate Change*

³⁵ Personnel from the Ministry of the Environment

³⁶ Paul E. Phillip: *Coastal Resources of Grenada: Beaches/Coastal Lagoons*

³⁷ FAO Fisheries and Aquaculture Technical Paper #530. *Climate change implications for fisheries and aquaculture. Overview of current scientific knowledge*

³⁸ Angelique Brathwaite, Andre Miller 2001. *Coral And Fish Assessments For Grenada And Carriacou Prepared for The Caribbean Planning for Adaptation to Global Climate Change Project (CPACC)*

- Storm intensity - The expected increase in intensity of tropical storms, coupled with increased stresses on coral reefs, could result in repeated physical damage of coral reefs without adequate coral recruitment. In addition to physical damage, storms impact negatively on reefs, by generating increased run off from land, bringing sediments and possibly the release of nutrients from moribund tissues³⁹.
- Sea Level Rise - Based on data that the maximum sustained upward reef growth is approximately 10 mm per year, the possibility of stressed reefs, (i.e. slower growth rates), and drowning becomes acute.⁴⁰

An assessment of Grenada's coral reefs in 2001⁴¹ concluded that:

- Hurricane Lenny in 1999 destroyed large stands of Carriacou's coral reefs and left behind a barren substrate.
- Coral bleaching was also observed at several of the sites monitored, but its abundance and intensity were much lower than disease occurrence
- There also appears to be a link between global climate change and coral diseases. In the case of Black Band Disease, its occurrence at specific sites during certain times of the year is thought to be linked to seasonal variation, increased sedimentation, nutrient enrichment, and elevated temperatures. Yellow Band Disease, which primarily

affects *Montastrea anulis*, has also been linked with coral bleaching and therefore elevated sea surface temperatures (Goreau et al, 1998). YBD is considered an important predecessor to mortality in *Montastrea annularis* in much of the Caribbean region⁴².

Interviews with key stakeholders⁴³ highlighted other climate related impacts including:

- Increasing sea surface temperatures - cause the bacteria to move out of the coral and leave the coral colorless or "bleached".
- Ocean acidification - the coral will dissolve with increasing acidification and organisms that require calcium will have difficulties e.g. shell fish.
- Extreme events like hurricanes physically damage the coral.

Fisheries

An assessment of the scientific literature concluded that general impacts on marine and aquatic systems as a result of large-scale changes related to temperature, winds and acidification can be predicted, in some cases with a high degree of confidence⁴⁴.

The assessment goes on to state that over "rapid" time scales (a few years) there is high confidence that increasing temperatures will have negative impacts on the physiology of fish because of limited oxygen transport to tissues at higher temperatures.

³⁹ *Ibid*

⁴⁰ *Ibid*

⁴¹ *Ibid*

⁴² *Ibid*

⁴³ *Personnel from Fisheries Unit and Ministry of the Environment*

⁴⁴ *FAO Fisheries and Aquaculture Technical Paper #530. Climate change implications for fisheries and aquaculture. Overview of current scientific knowledge*

These constraints on physiology will result in changes in distributions of both freshwater and marine species, and likely cause changes in abundance as recruitment processes are impacted. Changes in the timing of life history events are expected with climate change (high confidence). Short life span, rapid turnover species, for example plankton, squid and small pelagic fishes, are those most likely to experience such changes.

At intermediate time scales (a few years to a decade), temperature-mediated physiological stresses and phenology changes will impact the recruitment success and therefore the abundances of many marine and aquatic populations (high confidence). Changes in abundance will alter the composition of marine and aquatic communities, with possible consequences for the structure and productivity of these marine ecosystems.

At long time scales (multidecadal), predicted impacts depend upon changes in net primary production in the oceans and its transfer to higher trophic levels.

There are no internal reports on the climate related impacts on Grenada's fisheries sector. However, at the regional level, climate change is expected to have a wide range of impacts on the Caribbean fisheries sector and the fish stocks/resources it utilizes. These impacts include changes in distribution and structure of exploited

populations, habitats, fishing conditions, and loss or degradation of fishing sites and infrastructure. Climate models suggest that fish catches in low-latitude regions may decline as a result of reduced vertical mixing of the water column and, hence, reduced recycling of nutrients. Extreme weather events (e.g. hurricanes) associated with abnormally high sea surface temperatures are damaging coastal ecosystems and infrastructure, and increasing risk to fishers.⁴⁵

Modeling for the Caribbean region show that the annual temperature will increase by end of the 21st century with a range from 1.4°C to 3.2°C (median of 2.0°C) and that surface water temperature will increase with 1° C. Research has shown that a sea surface temperature increase of 1°C will have large effects on the distribution of Dolphin fish (*Coryphaena* spp.).

Interviews with key stakeholders⁴⁶ highlighted other climate related impacts including:

- Increased temperatures will cause the fish to migrate northwards and the distribution of fish in the world will change;
- There may be a scarcity of fish in tropical regions;
- Sea level rise could damage the habitat for fish e.g. coral reefs and lagoons, and result in a decline in the production and availability of some species.

⁴⁵ PIF for FEG Full sized project. *Climate Change Adaptation in the Eastern Caribbean Fisheries Sector*

⁴⁶ Personnel from Fisheries Unit and Ministry of the Environment

2.2.6 Summary

Table 2 below summarises the observed and potential climate change impacts discussed in the preceding sections.

Table 2 - Summary of Climate Change Impacts on Biodiversity

Ecosystem	Observed Climate-related Impact	Other Potential Climate Change Impact
I. Terrestrial Biodiversity a. Vegetation b. Wildlife	<ul style="list-style-type: none"> ■ Physical damage from extreme events and excessive rainfall ■ Physical damage from forest and bush fires ■ Habitat destruction created conditions for the spread of invasive species <ul style="list-style-type: none"> ■ Loss of life and reduction in population from extreme events and excessive rainfall ■ Habitat damage from extreme events and excessive rainfall ■ Reduction in food availability from extreme events and excessive rainfall 	<ul style="list-style-type: none"> ■ Uphill migration of some species in response to reduced rainfall <ul style="list-style-type: none"> ■ Habitat loss to Grenada Dove as a result of reduced rainfall
2. Freshwater Biodiversity a. Ecosystems b. Species	<ul style="list-style-type: none"> ■ Low and non-existent river flows during dry season. <ul style="list-style-type: none"> ■ Washed away from habitat during flooding 	<ul style="list-style-type: none"> ■ Disappearance of freshwater lakes ■ Changes in quantity and timing of river flows <ul style="list-style-type: none"> ■ Changes in abundance and species diversity of riverine fishes

Table 2 - Summary of Climate Change Impacts on Biodiversity

Ecosystem	Observed Climate-related Impact	Other Potential Climate Change Impact
3. Coastal and Marine Biodiversity a. Mangroves b. Coastal Lagoons c. Beaches d. Sea Grass	<ul style="list-style-type: none"> ■ Physical damage by extreme events ■ Losses due to increased salinity and higher sea surface temperatures ■ High algae growth and low oxygen levels result in "fish kills" ■ Erosion caused by hurricanes ■ Submergence due to sea level rise ■ Salt water intrusion from sea level rise ■ Reduction in sand as a result of reef degradation ■ Uprooting by extreme events 	<ul style="list-style-type: none"> ■ Inability to migrate in response to sea level rise ■ Potential for hypoxic events as a result of increased salinity and reduced oxygen from sea level rise, increases temperatures and precipitation variability. ■ Potential for eutrophication as a result of increased nutrient and sediment inputs ■ Erosion from storms ■ Increased temperatures negatively affect organisms that live on the beach ■ Denudation from extreme events ■ Loss of white coral particles due to ocean acidification ■ Reduction in sunlight due to sea level rise could hamper growth ■ Increased ocean acidification could negatively affect plants
e. Coral Reefs f. Fisheries	<ul style="list-style-type: none"> ■ Physical damage from extreme events ■ Coral bleaching ■ Increased sea surface temperatures create favourable conditions for black band and yellow band diseases ■ None 	<ul style="list-style-type: none"> ■ Breakdown of coral from increased acidification ■ Extreme events generate increased runoff from land sources ■ Reef drowning due to slow rate of growth vis-a-vis rate of sea level rise ■ Changes in distribution and abundance ■ Damage to habitat from extreme events and sea level rise

PART I I

3.0 NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN IMPLEMENTATION AND MAINSTREAMING OF BIODIVERSITY

3.1 Context:

Grenada Fifth National Report to the Convention on Biological Diversity has been prepared in parallel to the revision and updating of the National Biological Strategy and Action Plan.

The methodology employed included desk reviews and a series of local and national consultations. First a rapid assessment was completed. This rapid assessment included a stocktaking exercise and a review of the relevant plans, policies and reports, the identification of stakeholders, a gap analysis of the implementation of the NBSAP, and a rapid assessment of causes and consequences of biodiversity loss highlighting the value of biodiversity and ecosystems services and their contribution to human wellbeing.

This was followed by a series of local and national level consultations to identify and agreed on the national targets, priorities and principles for biodiversity conservation.



3.2 Targets:

Ten of the twenty Aichi targets were deemed to be the most important for the Grenadian context. The key criteria employed in this determination were linkages to income generation, poverty alleviation and livelihoods, relevance to Grenadian resource endowment and culture, current state of biodiversity and availability of resources. It was however quite clear that all twenty targets were quite important and relevant for Grenada and that the prioritization was mainly to assist in the planning for the short to medium term because of resource constraints.

The participants also pointed out the interconnectedness and cross cutting nature of the targets and that by addressing one target several other targets may be addressed (in full or in part).

The ten priority targets identified were as follows:-

Target 1: Awareness and valuation of biodiversity

Target 2: Integration and mainstreaming

Target 6: Sustainable management of marine resources

Target 7: Sustainable Agriculture, aquaculture and forestry

Target 10: Coral reefs and vulnerable ecosystems

Target 11: Protected areas increased and improved

Target 14: Ecosystem restoration

Target 17: Implementing NBSAP

Target 19: Knowledge, science and technology shared and applied

Target 20: Resource mobilization increased

It was clear from the discussions that the above priorities were based on the participants' appreciation of biodiversity on the sectoral level. Hence issues relating to coral reefs, forests, mangroves, agriculture, fishing, water, health and livelihoods were most dominant. The need for resources, public education, awareness, integration, collaboration and mainstreaming was also quite dominant in the discussion.

The issue of high level leadership was also raised. There was the view that Grenada's profile on biodiversity

should facilitate the political will for action to achieve the priority targets.

During the reporting period and at present period the Country's Head of State functions as a co-chair of the Caribbean Challenge Initiative, the co-chair of the Global Island Partnership and chaired the Alliance of Small Island States (AOSIS) from 2007 to 2011.

Grenadian nationals also took leadership positions on various convention bodies including the Bureau of the Subsidiary Body on Scientific Technical and Technological Advice (SBSTTA), the Bureau of the Conference of the Parties, the Bureau of the Inter-Governmental Platform for Biodiversity and Ecosystem Services and the Council of the International Union for the Conservation of Nature.

3.3 Principles and Priorities:

From the consultations held, the participants agreed on a cluster of key principles to be applied on the national level and several priorities to guide national interventions.

Principles:

The agreed principles were as follows:-

- Equity and social justice must underpin national interventions
- Participatory governance and holistic approaches must be integral factors
- Specific focus must be on Sustainable economy

- Ecosystem based approaches are fundamental and most relevant in Grenada context
- Public awareness, education and capacity building on biodiversity are national imperatives
- Biodiversity must be perceived as part of the national heritage

Priorities:

The identified priorities are as follows:

- Environmental governance to be elevated in national decision making
- Review, drafting and implementation of environmental policies and legislation including the development of institutional and administrative frameworks and mechanisms.
- Specific legislation on water management, land use policy and enforcement and accountability mechanisms.
- Education and public awareness aimed at greater appreciation of the importance of biodiversity to livelihoods and the need for behavioral change for conservation of biodiversity.
- Knowledge management through research, data and information management, valuation of biodiversity, use of appropriate technologies and systems for conservation.
- Capacity building and institutional strengthening for enhanced cooperation and collaboration.
- Demonstration projects for land use, species conservation and livelihoods and sustainable job creation.
- Protection of genetic biodiversity through research and development of germplasm banks.
- Financial resource mobilization from internal and external sources including innovative sources for implementation of the revised and updated NBSAP.

3.4 Policy, Planning and Legislative Frameworks

Extensive work has been done previously on the policy, planning and legislative frameworks relating to biodiversity conservation in Grenada. A range of new policy and planning documents were elaborated on the national level and several new pieces of legislation were enacted. Nevertheless, there are many existing gaps. Additionally, these frameworks must have the inbuilt flexibility to respond to change in national circumstances relating to biodiversity. For example, the issue of access and benefits has not yet factored in these frameworks thus requiring specific actions.

Nevertheless, it was generally recognized that Grenada was replete with policy, planning and legislative frameworks with respect to biodiversity conservation.

Participants identified lack of enforcement as the key challenge. This is compounded by a lack of leadership on various levels and the lack of appreciation on the long term impacts of biodiversity loss and the role that biodiversity can play in addressing society's social and economic ills.

There was a call for updating some of the existing legislation but in the main it was generally agreed that adequate frameworks exist for biodiversity conservation.

Policy and Planning Framework

The following are key policy and planning documents:

- National Environmental Policy and Management Strategy (2005)
- National Strategic Development Plan (2005)
- Land and Marine Management Strategy (2011)
- National Biodiversity Strategy and Action Plan (2000)
- Grenada Nutmeg Sector Development Strategy 2010-2015
- Draft National Policy and Strategy for Modernizing Agriculture (2006)
- Draft Biotechnology Policy (2005)
- Draft Land Use Policy (Carriacou) (2013)
- National Physical Development Plan (2003)
- National Action Plan (United Nations Convention to Combat Desertification and Drought - UNCCD) (2005) - Planned alignment to the UNCCD 10-year Strategic Plan in 2014.
- Grenada Protected Area Systems Plan (2009)
- Forest Policy Strategic Plan 2001-2011
- National Climate Change Policy and Strategy (2005)
- National Forest Policy (1999)
- Draft Plan and Policy for System of National Parks and Protected Area (2005)
- Annual Agricultural Review (2009)
- Tourism Policy Framework for Grenada (2010)
- Grenada Board of Tourism Strategic Plan (2011)
- National Energy Policy of Grenada: A Low Carbon Strategy for Grenada (2011)
- Land and Marine Management Strategy Assessment, Policy and Strategic Plan of action (2011)
- Grenada Waste Management Strategy (2003)
- Grenada Growth and Poverty Reduction Strategy (2012-2016).
- Grenada's Economic Transformation and Poverty Reduction Strategy 2013-2018.
- An Alternative Growth and Poverty Reduction Strategy for Grenada (2012)
- National Report from Grenada to the 10th Session UNFF (2012)
- RIO+20 National Submission to UNDESA (2012)
- UNDESA study: Carriacou Road Map for Grenada Economy (2012)
- Action plan for implementing the UNCBD programme of work on protected areas (2012). Studies on willingness pay and economic valuation for PA.
- UNDESA study: Climate Change Adaptation in Grenada: Water Resources, Coastal Ecosystems and Renewable Energy (2012)
- CARIBSAVE- Climate Change Risk Analysis (2012)
- Implementing a "Ridge to Reef" Approach to Protecting Biodiversity and Ecosystems Functions Within and Around Protected Areas in Grenada.(2014-2019)

Legislative Framework

The key legislation includes the following principal legislation including subsequent amendments:

- Draft Environmental Management Act, 2005
- Stock Trespass Act
- Forest and Water Conservation Act
- Physical Planning and Control Act 2002
- Waste Management Act, 2002
- Environmental Levy Act 2000
- Grenada Solid Waste Management Authority Act, 1995
- Forest Soil and Water Conservation Act Cap 116
- Carriacou Land Settlement and Corporation Development Control Act, 1976

- Crown Lands Act, CAP 159
- Beach Protection Act, CAP 29
- Forest Soil and Water Conservation Ordinance, No 1 (1949) and No 34 (1989)
- Bird and Other Wildlife Protection Act, CAP 34
- Wildlife and Birds Sanctuary Act, CAP 339
- National Parks and Protected Areas Act, CAP 206 (1990)
- Draft Protected Areas, Forestry and Wildlife Bill
- Draft National Protected Area Trust Bill

3.5 Multilateral Environment Agreements

Since 2000 Grenada has signed the Nagoya Protocol, signed and ratified the Cartagena Protocol on Biosafety and acceded to the Ramsar Convention and the SPAW and LBS protocols. Work is currently ongoing for ratification of several multilateral environmental agreements.

A national committee of MEA focal Points has been established in 2002. The main objectives of the Committee is to provide updates on existing and proposed MEAs to which Grenada is State Party or for which Grenada wishes to become a State Party including determination of ratification processes, national implications and implementation obligations.

Table 3 provides a status of MEA Ratification.

Table 3: Status of Multilateral Environmental Agreements (MEA) Ratification (2014)

Multilateral Environmental Agreements (MEA)	Status
1. Nagoya Protocol	Signed December 22, 2001 Ratification pending
2. Cartagena Protocol	Signed May 24, 2000 Ratified February 5, 2004
3. SPAW Protocol	State Party acceded
4. LBS Protocol	State Party acceded
5. Ramsar Convention	Acceded September 22, 2012 One Ramsar site declared
6. Basel Convention	Ratification Pending
7. Rotterdam Convention	Ratification Pending
8. Stockholm Convention	Ratification Pending
9. CMS Convention	Ratification Pending

In addition to the above processes Grenada has been collaborating with other countries in the Caribbean region on a range of regional biodiversity related projects including the following:

- OECS Protected Areas and Associated Livelihoods
- Sustainable Land Management
- Integrated Watershed and Coastal Areas Management
- Caribbean Challenge Initiative
- Caribbean Biodiversity Fund
- Pilot Programme for Climate Resilience
- Building Capacity for Coastal Ecosystem Based Adaptation in SIDS
- Ridge to Reefs
- Sustainable Financing and management of Eastern Caribbean Marine

- Biodiversity and Protected Areas Management Programme
- World Bank Open Data for Resilience Initiative
- Caribbean Marine Atlas
- Reef Guardian Programme

National Projects Implemented

On the national level several biodiversity related project were implemented during the reporting period.

In line with Aichi Target 11 on protected areas for example, significant progress was achieved with the expansion of the protected areas network.

The Terrestrial Protected Areas (TPA) estate increased from 1765 Hectares (Ha) in 2000 to 2001 Ha in 2014, equivalent to 13.4% increase. This occurred due to the legal declaration of the 236 Ha Annandale Forest Reserve in 2006.⁴⁷ Marine protected areas (MPAs) achieved major growth with the legalization of the Molinere-Beausejour MPA and the Woburn Clarkes court Bay MPA in 2001, totaling 498 Ha of sea space. The Sandy Island Oyster Bed MPA although actively managed is awaiting legal designation.⁴⁸ This designation will add another 787 hectares to the existing MPA. This trend is expected to continue cognizant of the Grenada Declaration which targets effective conservation of at

least 25% of terrestrial and near shore marine areas by 2020 in accordance with Grenada's declaration made at COP 8. In fact, the Ridge to Reef Project⁴⁹ plans to expand the MPA and TPA estates significantly by end of 2019.

At Cop 8 in Brazil Grenada made a bold declaration to protect 25% of its territorial and coastal and marine ecosystem.

Subsequently, Grenada joined forces with seven other Caribbean countries under the Caribbean Challenge Initiative (CCI) which seeks to expand and consolidate the Caribbean network of protected areas, both marine and terrestrial. The countries pledge to effectively conserve 20% of their resources by 2020.

Grenada is now an active member of the Caribbean Biodiversity Fund which seeks to leverage resources for protected areas by developing sustainable finance mechanism for accessing long-term and reliable financing.

Box 4: Grenada Declaration

Grenada Declaration 2008. Minister Responsible for Environment Ann David Antoine to effectively conserve and manage at least 25% of the terrestrial and marine and nearshore coastal environment by the year 2020.

⁴⁷ Although only 5 terrestrial protected areas (TPAs) are officially designated, the Forestry Division currently actively manages 13 TPAs.

⁴⁸ Constitutes 50 Ha of land and 737 Ha of marine space.

⁴⁹ Funded by the Global Environment Facility (GEF) and the United Nations Development Programme (UNDP), this project is designed to ensure that biodiversity and ecosystem functions within and around marine and terrestrial protected areas in Grenada are better protected from threats through the adoption of an integrated "Ridge to Reef" approach that increases protected areas management effectiveness and applies targeted SLM practices.

GMPA Sandy Island/Oyster Bed Marine Protected Area

Status
Launched: July 2010
Under management

GMPA Moliniere/Beausejour Marine Protected Area

Status
Launched: September 2010
Under Management

GMPA Woburn/Clark's Court Bay Marine Protected Area

Status
Scheduled for Launching
Last Quarter 2012

GMPA Grand Anse Marine Protected Area

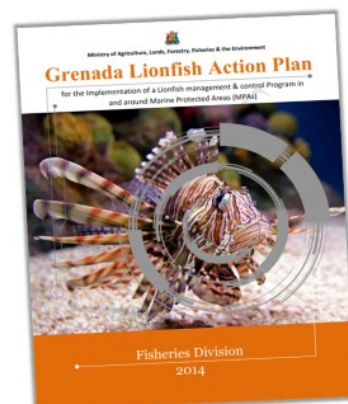
Status
Planning Stage



Education and Public Awareness

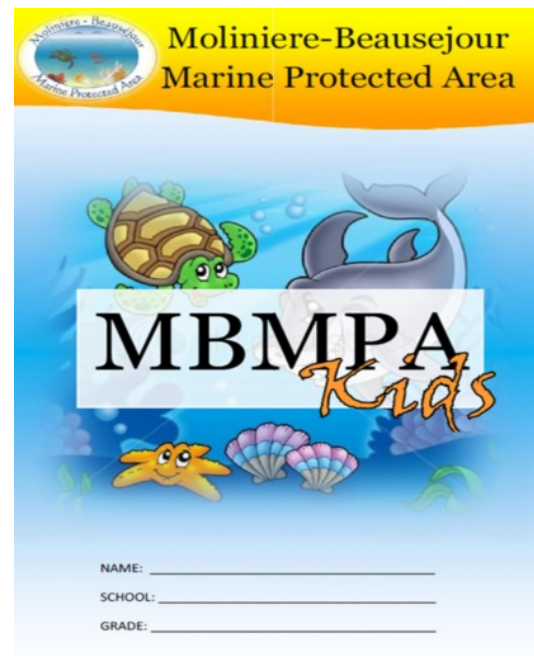
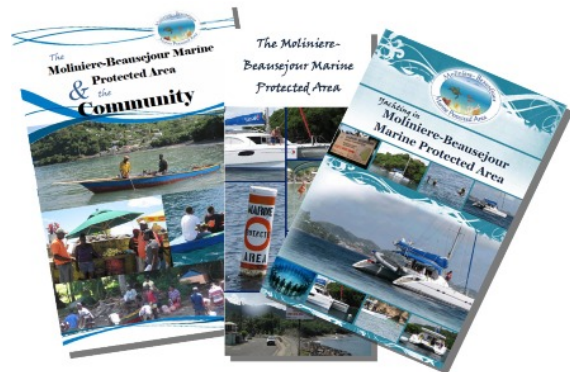
During the period of study several education and public awareness projects were implemented. For example, the Reef Guardian Programme involved farmers, fishermen and school children on the imperatives for biodiversity conservation. Many public sector initiated and donor funded projects included elements of public education and awareness on biodiversity. In addition, several locally based non-governmental organizations have

implemented public education and awareness programmes on the areas for example of turtle watching, sustainable farming, sustainable fishing, pollution control and national clean-up campaigns. The programme on the lionfish is a case in point with the elaboration of the Grenada lionfish action plan



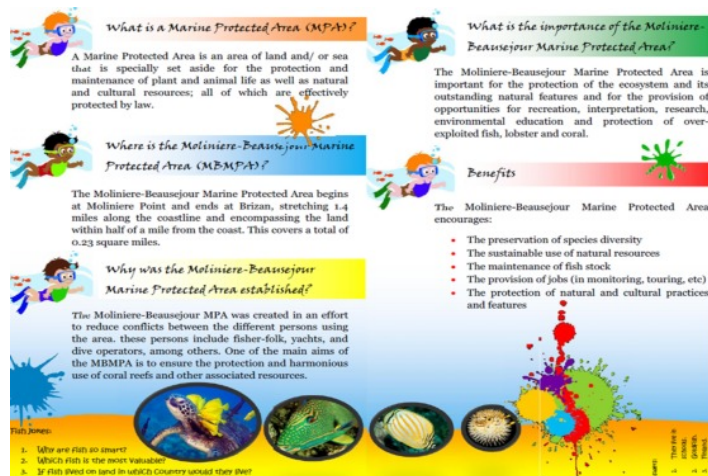
During the elaboration of this report a comprehensive media program of biodiversity was released which included media spotlights, skits and calypsos.

In addition work continued on the upgrading of the National Clearing-house Mechanism. The latest version of the content management system was installed. The URL is www.gd.chm-cbd.net.



The link below is the Fisheries Division's MPA Summer Camp video report

https://www.youtube.com/watch?v=d7p__fQ3IU8&feature=youtu.be



Mangrove Replanting and Forest Rehabilitation

During the period of study there were several initiatives in the areas of mangrove restoration and forest replanting and rehabilitation. Given the devastation of these

ecosystems especially as a result of damage sustained during Hurricane Ivan in 2004 were implemented in the area of ecosystem restoration.

Box 5: Mangrove Restoration Initiatives - facilitated by the Grenada Fund for Conservation 2009-2014

1. Lower Woburn Mangrove Restoration Project: Implemented by the Woburn/Woodlands Development Organization with funding provided through the Global Environment Facility (US\$ 45,000). Planted 2500 pre-rooted red and white mangrove seedlings, including coastal shrubs in buffer area. Attained low to medium survivability due to challenges with industrial wastewater pollution and high temperatures. Area is now been used as a research site for Caribbean Waterbird Census.
2. Calivigny Mangrove Project: Implemented by the Calivigny Development Organization in collaboration with GFC, with funding from TNC to the tune of US\$ 29,000. Planted 500 pre-rooted red mangrove, resulting in approximately 90% survival rate.
3. Telescope Mangrove Restoration Project: Through the Water's Edge Project, 4000 mangrove plants will be planted along the eastern coastline of Telescope, St. Andrew's. this is part of 4 communities to benefit from coastal restoration as part of the Water Edge Project 2011-2015

3.6 Access and Benefit Sharing:

The Access and Benefit Sharing (ABS) is a new concept and as such the laws, policy and regulations that currently exist does not contain this essential element. There are documents existing that take into consideration issues of the environment but do not explicitly cover ABS issues such as biodiversity and genetic resources.

Emphasis needs to be placed on the fair and equitable sharing of benefits arising from the use of genetic resources and to ensure that access to genetic resources are in keeping with local policies, the Convention on Biological Diversity and its relevant provisions. There is also the need to ensure that there is equitable sharing of the benefits to be derived from the commercial and other use of the genetic resources. The current draft Environmental Bill does not contain provisions on ABS and Traditional Knowledge (TDK).

Access to Plant Genetic Resources (PGR) has reduced significantly after the passage of Hurricane Ivan and Emily (2004 and 2005 respectively). However on the national level, there is no specific definition of key Access and Benefit Sharing terms developed, when making reference to biological and genetic resources, biological and genetic material and bioprospecting and biopiracy. Additionally, no guidelines for harvesting and benefit sharing, amongst others, exist.

Grenada presently has no policy / legislation in place pertaining to sharing of benefits as it relates to the use of PGR. This therefore highlights the fact that farmers rights with respect to sharing of benefits deriving from PGR are not legislated, however it is understood to be regulated by the Ministry of Agriculture. The situation with respect to obtaining PGR is gradually improving since farmers are becoming more aware and informed on how to partially meet their planting needs by sourcing planting materials on their own farms or from reputable suppliers.

Restrictions to entry of certain types of Plant Genetic resources exist and the strengthening of the National Biosafety Authority (NBA) which is the regulatory body that ensures the safety of planting materials with respect to genetic modification that are entering Grenada. The restriction to entry of PGR in Grenada will also ensure that the possibility of Genetic Modified Organisms (GMO) to become invasive and displace natural stands or convert into a weed that is difficult to control and the harming of beneficial organisms will be addressed under the NBA.

Of paramount importance is the maintenance and or enhancement of access to PGR which can result in:

- Significant contribution to food security and poverty alleviation;
- Reduction in the high levels of unemployment;
- Increased conservation of biological diversity and environmental stability

The focus needs to be placed on how to maintain, recover and promote genetic resources necessary for sustainable agriculture and how to incorporate the information on key ecosystems into national accounts and decisions on national development projects. Additionally economic instruments to promote the sustainable use of biological resources need to be developed and implemented.

Strategies need to be developed that will support enabling activities that facilitate national and locally based regional institutions in continuing and expanding on germplasm research and development and biological pest control for agriculture. Additionally the valuation of ecosystems of national importance needs to be determined and that the users of the resources bear the cost resulting from environmental degradation.

The need therefore arises for:

- The development of policy, legislation and incentives to support germplasm and biological pest control research and development;
- The strengthening of the capacity of key institutions involved in the collection, identification, characterisation, storing, retrieving and documenting information related to plant genetic resources;
- The development of a national germplasm programme which focuses on awareness, certification and standards for seed exchange;
- The development of an education awareness programme for farmers geared towards biological pests;
- The forging and strengthening of linkages with regional and global institutions and relevant agencies involved in research and development;

- Conducting consultations with key stakeholders and resource users in order to identify the different ecosystems of national importance;
- Personnel to be trained from the relevant ministries in valuation methodologies and for the valuation of ecosystems to be conducted;
- Creating awareness among policy makers and senior government officials on the importance and results of the valuation and how the results can be incorporated into national accounting;
- Promoting biodiversity preservation and conservation using an incentive scheme;
- Revising the fees imposed on users of the resources;
- Establish a system to monitor the use of biological resources.
- More elaborate research into the possibilities of using genetic resources and traditional knowledge for botanicals, nutraceuticals, food flavourings, medical treatments, the spa and wellness industries etc.

3.7 Biodiversity Support Mechanisms

The National Strategic Development Plan and the National Environment Policy and Management Strategy are the two foremost policy documents which provide for the integration of environmental concerns in national development plans and programmes. The National Environmental Policy and Management Strategy attempts to control environmental degradation and to ensure that sound environmental management is fully integrated into the national development policy framework.

Further, several sectoral policies were developed to address environmental management concerns. The National Climate Change Policy, National Agricultural Policy, Tourism Master Plan, National Forest Policy, Poverty Eradication Strategy and the Energy Policy have all provided for the issue of environment management. The National Climate Change Policy, for example, includes a section on the direct linkages between climate change and biological diversity.

The Physical Planning and Development Control Act is the premier domestic legislation which seeks to protect natural and cultural heritage in Grenada. The Act establishes the boundaries for physical planning and development control issues, including environment impact assessments, enforcement of development control, and protection of the natural ecosystems and establishes the institutional framework for environmental management. Biodiversity conservation however, is not directly catered for under Section 25 of the Act which deals with environmental impact assessment.

Grenada has established a Sustainable Development Council (SDC) comprising broad-based representation from the major sectors to constitute a forum for discussion, analysis and to advise policy makers on contemporary issues of national development. In fact, the SDC has functioned as a forum for ventilating several issues relating to biodiversity conservation and management in the context of environmental management.

Grenada has also established a committee of MEAs focal points. The objective is to provide updates on existing and proposed MEAs of which Grenada is a State Party or of which Grenada wishes to become a State Party, including process to ratification, implications and implementation obligations.

3.8 Issues Relating to Biodiversity Mainstream

Effective national action highly depends on developing institutional, policy and legal framework that support effective planning for and management of biodiversity. The benefits gained from conservation and sustainable use of biological resources and the environmental, social and economic costs associated with the loss of these resources must be considered when dealing with national decision-making.

There are many gaps listed below that exist in Grenada with respect to the effective mainstreaming of biological diversity and the following issues need to be addressed in a timely manner:

- A national policy for land management;
- Incentives for the protection of critical ecosystems on the island (biodiversity hot spots and endangered areas);
- Proliferation of Modification of policies which negatively impact the environment;
- Implementation of appropriate policies and strategies that contribute to the conservation of biodiversity;

- Effective enforcement of existing legislation;
- Outdated legislation to include the regulation of activities with significant adverse impacts on key habitats and species of significance;
- Awareness amongst the policy makers and stakeholders on the value of biodiversity, its sustainable use and conservation;
- Comprehensive information for use;
- Baseline biological/environmental data and inventories on key species and habitats;
- Management plans for key ecosystems, biological and genetic resources;
- Focus on Institutional strengthening;
- Development of a local repository for representative samples of biodiversity;
- Environmental costs should be incorporated into the planning process;
- Inclusion of elements of marine biodiversity within conservation areas, plans and strategies, and the need to conserve them effectively and preserve any potential options for their sustainable use and enjoyment;
- Need to identify elements of biodiversity under threat such as rare, endemic and endangered species and vulnerable habitats;
- Need to identify areas of biological diversity of greatest significance for local conservation;
- Strategy needs to be developed for the continued over-exploitation and loss of commercially valuable elements of biodiversity;
- Policies / strategies are to be developed to achieve the goals of our international obligations (under the Convention on Biological Diversity) and to design a comprehensive inventory of the biodiversity to be conserved and managed.

The National Biodiversity Strategy and Action Plan (2000) had outlined the following critical and measurable objectives for biological diversity conservations. To date these remain very important since there is the need and urgency to:

- Provide broad-based support for conservation and sustainable use of biodiversity;
- Use key tools e.g. Environment Impact Assessment (EIAs) in conservation and management of biodiversity.
- Develop sustained financial mechanisms to support biodiversity conservation and management.
- Develop and implement an integrated approach to conservation and management of goods and services provided by ecosystems.
- Protect key ecosystems from negative human induced impacts;
- Develop and encourage sustainable utilization of biological resources that are essential to the livelihood of local communities;
- Maintain, recover and promote genetic resources necessary for sustainable agriculture;
- Ensure a fair and equitable sharing of the benefits arising out of the utilization of genetic and ecosystem resources and;
- Provide information on key ecosystems for incorporation into national accounts and decisions on national development projects;
- Design a coordinated and strategic approach to assessing and managing biodiversity and supporting research efforts;
- Develop a systematic, long-term commitment to developing a national biodiversity inventory repository;

- Ensure that there is an agreed national, systematic and standardised methods and protocols for describing, assessing and managing biodiversity including data entry and information management systems;
- Build and improve on the taxonomic knowledge that exist with emphasis being placed on the declining human and institutional capacity in taxonomy;
- Increase the emphasis being placed on traditional and local knowledge and information /data gathered by the private sector.

In conclusion, activities such as creating awareness on biological diversity and conservation issues in Grenada, a national Land Use Policy for Grenada, mapping and

strengthening the management of key ecosystems and biological pest control, revision and updating of existing legislation related to biodiversity conservation and the incorporation of ecosystem valuation into national accounting need to be addressed and taken into consideration in order to effectively address biodiversity issues. As indicated by the residents of the communities where there are major concerns about biodiversity conservation, capacity building for the conservation of genetic material and the promotion of sustainable use of genetic resources are critical issues to be considered when devising a national plan or policy that addresses biodi-

PART III

4.0 PROGRESS TOWARDS THE AICHI BIODIVERSITY TARGETS AND THE RELEVANT 2015 TARGETS OF THE MILLENNIUM DEVELOPMENT GOALS

4.1 The Strategic Plan for Biodiversity 2011-2020 and its Aichi Targets.

Grenada fully subscribes to the Strategic Plan for Biodiversity and the Aichi Targets. The implementation of the Strategic Plan is however conditioned on the existing socio-economic realities of the country as indicated in Part I of this report. National capacity limitations including access to adequate levels of financial, human and technical resources have negatively impacted on implementation. In the main implementation is driven by the availability of external resources.

In light of limited resources, Grenada selected ten of the twenty Aichi Target to focus its available resources for implementation see Table 4. It is envisaged that through a series of national and regional initiatives that Grenada will make substantial progress on the implementation of these targets.

It is also envisaged that while implementation coordination will be centralized in the public sector through the Environment Division of the Ministry of Agriculture, Lands, Forestry and

the Environment, that national implementation mechanisms will of necessity provide for active participation of the private sector, civil society organisations and local and community groups. While a sectoral approach is currently being used, efforts towards an integrated approach and mainstreaming are underway and are inevitable.

It is expected that all sectors will be involved in a holistic and coordinated manner and the direct linkages between biodiversity conservation and enhanced livelihood and wellbeing will be the driver for enhanced implementation.



Prime Minister (in white) on a tour of the Marine Protected Area

Table 4 - The Aichi Targets Status

Target	Prioritized	Achieved Progress	Activity Engaged/Planned
1. The Biodiversity awareness increased	Yes	Medium	Education and Public Awareness programme launched. Mainstreaming activities on-going Socio-economic linkages are been promoted
2. Biodiversity values integrated	Yes	Low	Valuation studies ongoing. Eco-system valuation study on parks and protected areas completed. Willingness to pay study completed. Mainstreaming activities on-going
3. Incentives harmful to biodiversity and promoting conservation reformed	–	Very low	Fiscal reforms ongoing in line with structural adjustment programme. Draft Energy Policy completed. Reform of the energy sector proposed
4. Sustainable consumption and production	–	Low	Education programming
5. Habitat loss halved or reduced	–	Very low	Education programming
6. Sustainable management of marine living resources	Yes	Low	Education and public awareness programme ongoing. Mainstreaming activities ongoing. Linkages to income and livelihood to be established
7. Sustainable agriculture, aquaculture and forestry	Yes	Low	Education and public awareness programme ongoing. Mainstreaming activities ongoing. Linkages to income and livelihood to be established.

Table 4 - The Aichi Targets Status

Target	Prioritized	Achieved Progress	Activity Engaged/Planned
8. Pollution reduced	–	Very low	Education and public awareness programme on-going. National clean-up campaigns organized and implemented.
9. Invasive alien species prevented and controlled	–	Very low	Education and public awareness programme ongoing. Mainstreaming activities ongoing. Linkages to income and livelihood to be established.
10. Pressures on vulnerable ecosystems reduced	Yes	Very low	Legislation to be enacted and enforcement mechanisms established.
11. Protected area increased and improved	Yes	Medium	Legislation and effective management on-going. Several protected areas designated. New protected areas to be designated. Draft legislation completed on National Conservation Trust. Sustainable finance plan completed. Management effectiveness study completed. Master plan for protected areas completed.
12. Extinction prevented	–	Very low	Education and public awareness programme on-going
13. Genetic diversity maintained	–	Very low	Education and public awareness programme on-going
14. Ecosystems and essential services safeguard	Yes	Very low	Legislation and effective management on-going

Table 4 - The Aichi Targets Status

Target	Prioritized	Achieved Progress	Activity Engaged/Planned
15. Ecosystems restored and resilience enhanced	–	Medium	Restoration initiatives on-going. Mangroves replanting initiatives on-going Forest rehabilitation initiatives ongoing. Coastal resilience programming on-going. Education and public awareness programming on-going.
16. Nagoya Protocol in force and operational	–	Medium	Ratification activities on-going. Ratification expected by early 2015. Capacity building programme launched.
17. NBSAPs adopted as policy instruments	Yes	Medium	Revising and updating of NBSAPS on-going. National level consultations on-going. Revised NBSAP to be adopted by mid 2015.
18. Traditional knowledge respected	–	Very low	Education and public awareness programming on-going.
19. Knowledge improved, shared and applied	Yes	Very low	Sustainable development initiatives on-going. Capacity Building and Human resources development activities proposed.
20. Financial resources from all sources increased (UNEP, 2013)	Yes	Low	Enhanced national capacity to access financing. Caribbean biodiversity fund established. Institutional strengthening for accessing finance proposed.

Prioritized Aichi Targets

The key implementation issues for the prioritized targets are as follows:

- Broad understanding required of intrinsic value of biodiversity valuation studies completed for mangroves and parks and protected areas.
- Low level knowledge and improper attitudes to biodiversity conservation.
- Recognition of synergies among complementary objectives.
- Comprehensive education programme organized around community development sustainable livelihoods, leadership and advocacy and applied demonstration.
- Capacity building for farmers, fishermen and community leaders in soil and water conservation practices linked to biodiversity conservation and food and nutrition security.
- A need to strengthen institutional capacity.
- Appreciation of the importance of biodiversity conservation on decision making level to national development, attainment of macroeconomic goals and social development goals.
- Leadership within the public sector to commit to and implement conservation goals amidst other challenges.
- Human resources assigned to coordinate implementation.
- Institutional arrangements and indicators for monitoring implementation.
- Strategic focus on financial resource mobilization for biodiversity conservation.
- Biodiversity as natural heritage and source of ecosystem goods and services.
- Lessons learnt for successful initiatives like draft land use policy for Carriacou.
- Sustainable agriculture and fishing practices.
- Biodiversity demonstration projects with adoption plan and replication mechanisms.
- Protected areas designated and effectively managed.
- Collaboration mechanisms among various stakeholders.
- Gaps in policy, legislative and governance frameworks.
- Capacity needed to address climate change and invasive alien species.
- Development of indicators.
- Prioritization of research and development
- Resource mobilization capacity enhancement.
- Enhanced budgetary allocation for conservation

It is generally agreed while implementation of the Aichi Targets depends on accessing external support that more aggressive strategic efforts on the national level are needed. Political will and leadership were deemed to be critical elements of a more aggressive and strategic effort.

4.2 Biodiversity and the Millennium Development Goals

Grenada has adopted the eight Millennium development goals and related target and indicators to be achieved by 2015.

While biodiversity conservation contributes to the achievement of all eight goals, the ecosystem based goods and services provided through biodiversity conservation contribute directly to the achievement of goal #1- Eradication of extreme hunger and poverty; goal #7-Ensure environmental sustainability and goal #8-Global partnership for development.

The loss of biodiversity and in particular, the decline in genetic resources for food security and agriculture, erosion of crop genetic diversity for use in agriculture, limited capacity for genetic resources conservation, a lack of focus on the maintenance of genetic variability, coupled with the increasing threat of climate change, natural disasters, invasive alien species, habitat destruction and unsustainable consumption and production patterns have provided significant obstacles for the achievement of the MDGs in Grenada.

Notwithstanding the foregoing there has been significant potential for positive outcomes between biodiver-

sity and MDG programming in Grenada. The general conclusion however is that programming for the MDGs has not been a main driver of development programming. This was a central conclusion in the 2005 Commonwealth Foundation's report on "Civil Society Perspectives on Attaining the Millennium Development Goals (MDGs) in the National Context of Grenada"⁵⁰. The report concluded that *"The MDGs, despite being adopted by the Government of Grenada since the year 2000, have not permeated the strategic planning processes of the government and CSOs."*⁵¹

This was reiterated by Williams (2010), who concluded that *"Full integration of the MDGs into national planning however has been hampered, both by a lack of financial resources and a lack of reliable and timely data for MDG monitoring."*⁵²

A 2012 update by the Commonwealth Foundation⁵³ found that some progress had been made on the environmental sustainability goal and that there were a number of initiatives geared at integrating the principles of sustainable development into the country's policies and programs. It concluded however, that although particular targets were on track, more broadly, there was civil society criticism that while environmental issues are on the policy agenda and the government is

⁵⁰ Moses A. 2005. *Civil Society Perspectives on Attaining the Millennium Development Goals (MDGs) in the National Context of Grenada*. Commonwealth Foundation. 2005

⁵¹ *Ibid*, pg. 12

⁵² Williams. M. 2010. *Assessment of Progress Towards the Millennium Development Goals (MDGs) in Grenada*

⁵³ *A Civil society review of progress towards the Millennium Development Goals in Commonwealth countries National Report: Grenada*. The Commonwealth Foundation. 2013.

party to various multilateral environmental agreements, there has been a lack of implementation of legislation, policies and strategies on environmental protection, and lack of co-ordination between different ministries.⁵⁴

Once such a situation continues, any initiatives to realize the environmental and related goals in the MDGs would

have to be initiated through environmental-related programming and not through MDG related programming.

The results of a qualitative review of the status of MDG implementation are indicated in Table 5 below.

Table 5: A Review of Grenada's Performance on the MDGs

Goals	Status
Goal 1: Eradicate extreme hunger and poverty	Partially achieved -indigent rate reduced from 11.2 % in 1998 to 2.4% in 2008 -poverty rate increased from 32% in 1998 to 37.7% in 2008 -unemployment rate exceeds 40% -external debt exceeds 100% -country under home grown structural adjustment programme
Goal 2: Achieve universal primary education	Achieved -close to 100% primary education enrollment level achieved -significant progress on secondary level education enrollment achieved -literacy rates 98%
Goal 3: Promoted gender equality and empower women	Partially achieved -stronger legislation enacted -women more prominent in national governance -women hold 6 of 15 seats in the house of Representatives as elected Parliamentarians -over 75% of Permanent Secretaries and Head of Department of the Public Sector are women. -women dominated the graduating classes in the primary and secondary levels -gender based institutions strengthened
Goal 4: Reduced child mortality	Achieved -significantly reduced infant mortality rate (close to zero) -significantly reduced mortality rates for children under 5 (close to zero) -high rate of vaccination -significantly improved nutrition levels

⁵⁴ *Ibid*, pg. 16

Table 5: A Review of Grenada's Performance on the MDGs

Goals	Status
Goal 5: Improved maternal health	<p>Achieved</p> <ul style="list-style-type: none"> -significantly reduced postpartum incidences -significantly improved access to quality healthcare for delivery -maternal mortality rates close to zero -deliveries done at hospitals with skilled personnel -reduced fertility rates -increased rates of contraceptives
Goal 6: Combat HIV/AIDS, Malaria and other diseases	<p>Partially achieved</p> <ul style="list-style-type: none"> -education and public awareness programming implemented. -stabilization of numbers affected -improved attitude for HIV care delivery -incidences of malaria and tuberculosis significantly reduced (close to zero)
Goal 7: Ensure environmental sustainability	<p>Partially achieved</p> <ul style="list-style-type: none"> -public education and awareness programme implemented. -protected areas increased and effectively managed. -policies and programmes implemented -ecosystems restoration programmes ongoing
Goal 8: Global partnership for development	<p>Partially achieved</p> <ul style="list-style-type: none"> -active in international diplomacy -enhanced access to international resources -active involvement of civil society in governance

4.3 Lessons learnt from the Implementation of the Convention.

The major lessons learnt from the implementation of the Convention in Grenada include the following:

- Political leadership and commitment to biodiversity conservation is necessary.
 - Direct linkages between biodiversity conservation and improved livelihood and wellbeing are critical for "buy-in" and ownership for behavioral change to move sustainable production and consumption patterns.
 - A recognition that improved macroeconomic and social development conditions directly depend upon biodiversity conservation and effective management.
 - There is a need to focus on the direct and indirect drivers of biodiversity loss.
- It is imperative to engender full participation and involvement of all major stakeholders including public, private, civil society and local communities in biodiversity decision making.
 - While sectoral approaches are most convenient there is the need to foster collaboration integration and holistic approaches on the national level.
 - The necessary institutional structures must be in place with the human resources, financial and technical capacities.
 - With the focus on implementation a comprehensive and sustained public education and awareness programme is an imperative.
 - There is great importance and utility in adopting regional approaches to biodiversity conservation and management.

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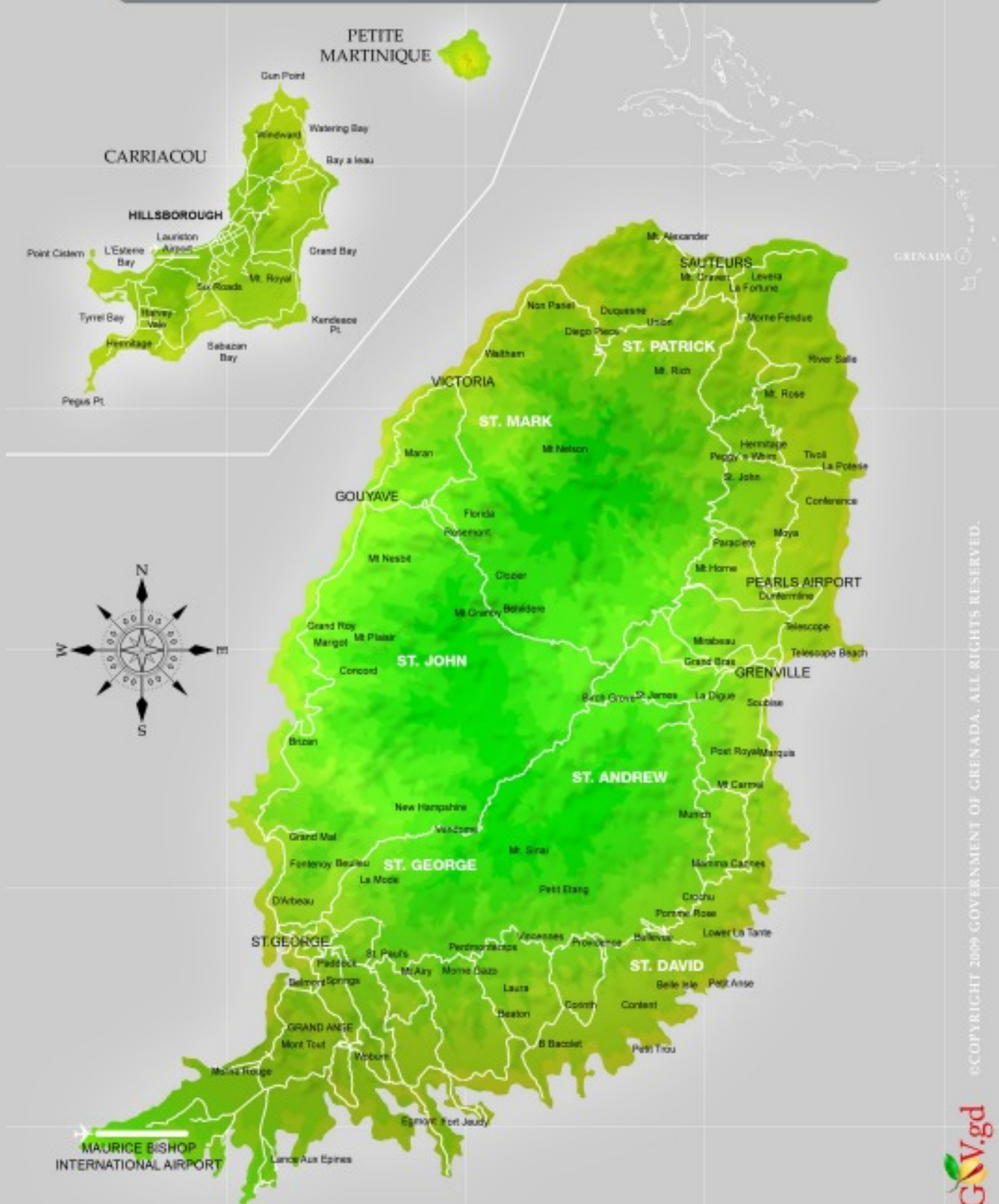
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