ST. VINCENT AND THE GRENADINES

FIFTH NATIONAL REPORT TO THE UNITED NATIONS CONVENTION ON BIOLOGICAL DIVERSITY

Aerial view of the Tobago Cays Marine Park
(Courtesy A. DeGraff)

Soil Conservation Techniques at Argyle, St. Vincent
Courtesy Nicholas Stephens

. Leatherback monitoring in Bloody Bay, Union Island
(Courtesy Union Island Environmental Attackers)

Submitted To

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St. Vincent and the Grenadines

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Abbreviations and Acronyms

CARDI	Caribbean Agriculture Research and Development Institute
CBD	Convention on Biological Diversity
CCA	Caribbean Conservation Association
CCI	Caribbean Challenge Initiative
CERMES	Centre for Resource Management and Environmental Studies
CHM	Clearing House Mechanism
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CTO	Caribbean Tourism Organisation
ECLAC	Economic Commission for Latin America and the Caribbean
EMA	Environmental Management Act
EC	Eastern Caribbean
ECMMA	Eastern Caribbean Marine Management Areas
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EPIC	Environmental Protection in the Caribbean
FAO	Food and Agriculture Organization
FISIM	Financial Intermediation Cervices Indirectly Measured
GDP	Gross Domestic Product
GIS	Government Information System
IAEA	International Atomic Energy Agency
IBAs	Important Bird Areas
KAP	Knowledge, Attitudes and Perception
MAFF	Ministry of Agriculture, Forestry and Fisheries
MarSIS	Marine Resource and Space-use Information System
MDG	Millennium Development Goal
MEAs	Multilateral Environmental Agreements

NBSAP	National Biodiversity Strategy and Action Plan
NCCAPP	National Climate Change Adaptation Policy Paper
NCSA	National Capacity Self-Assessment
NEMS	National Environmental Management Strategy
NESDP	National Economic and Social Development Plan
NGO	Non-governmental Organisation
NPA	National Parks, Rivers and Beaches Authority
NPDP	National Physical Development Plan
OECS	Organisation of Eastern Caribbean States
SIDS	Small Island Developing States
SusGren	Sustainable Grenadines Inc.
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
UWI	University of the West Indies

EXECUTIVE SUMMARY

St. Vincent and the Grenadines is an archipelagic State in the Eastern Caribbean. The main island, St. Vincent, is located to the north of the island archipelago. The Grenadines, a chain of 32 islands and cays, lie to the south, between St. Vincent and Grenada.

St. Vincent and the Grenadines became a signatory to the United Nations Convention on Biological Diversity (UNCBD) in 1992. This 5th National Report is prepared as part of the country's obligation under this Convention, to submit to the UNCBD Secretariat annual national reports on the status, trends and threats to biodiversity, and national strategies for its management and conservation.

The Status of Biodiversity

Biodiversity refers to the wide variety of ecosystems and living organisms: animals, plants or vegetative cover, their habitats and their genes. The diverse physical features and climatic conditions of St. Vincent and the Grenadines have resulted in a variety of ecosystems such as forests, grasslands, wetlands, coastal and marine ecosystems, which harbour and sustain high biodiversity and contribute to human well-being. These ecosystems are increasingly under threat from a variety of sources – natural and man-made.

To begin with, local crop diversity is expressed through the variation in the genetic and phenotypic characteristics of the agricultural plants. There has been a succession of crops on the islands, beginning with tobacco and followed by cotton, sugarcane, coconuts, arrowroot and bananas, and root crops such as dasheen, eddoes, tannias, yams, sweet potatoes, and cassava. A wide genetic base supports the production of these crops. The perennial tree crops and major fruits include coconut, breadfruit, citrus, mango, and indigenous papaya, pine-apple, passion fruit, avocado, and annonas (soursop, sugar apple, star apple, sapodilla). There is also a group of under-utilized fruits, medicinal plants, herbs and condiments

Animal and plant genetic diversity is managed primarily through conservation of species, habitats and ecosystems. There is currently no *in situ* conservation of wild crop relatives and wild plants for food and agriculture. Ex-situ species conservation efforts include captive breeding of the St. Vincent Parrot.

To date, the country has recorded some 14 endemic animals, 19 endemic plants and 29 regionally endemic tree species. Five mammals are Lesser Antillean endemics, two of which are restricted to Grenada and St. Vincent and the Grenadines.

In addition to the endemics, there are over 1,150 species of plants and 163 species of ferns, including 15 endemic flowering plants and 4 ferns. The faunal diversity includes all five groups of faunal vertebrates including 7 species of amphibians, over 20 species of reptiles, 170 species of birds, 22 species of mammals, and 516 species of marine biodiversity. Added to these are thousands (and perhaps millions) of invertebrates, of which approximately 500 have been identified.

It was estimated that the islands contained about 31,500 acres (12,748 hectares) of tropical forests representing approximately 29% of the land area. Natural forest constitute about 70% of this area, with planted forest and agro-forest representing about 25% and 5%, respectively. In the Grenadines there are few areas of natural forest cover.

Over 170 bird species have been recorded, 95 of which breed on the islands and which also include a number of regionally and globally important populations. The *Amazona guildingii*, the country's national bird, is an important symbol for conservation. The bird population includes 76 species of waterbirds and seabirds.

The country has recorded 22 species of terrestrial mammals, excluding agricultural and domestic species, 18 species of terrestrial reptiles, four species of endangered sea turtles, thousands of species of terrestrial invertebrates and seven species of amphibians.

The coastal and marine habitats include seagrass and lagoons, areas of mangrove and a variety of patch, fringing and bank barrier reefs. Detailed information on the distribution and abundance of coastal and marine habitats is lacking for the mainland of St. Vincent but there is extensive information on the Grenadine Islands.

The Commercial Value of Biodiversity

The country's diverse endowment of biological resources has played a large role in the provisioning services such as the availability of high quality food,

potable water and touristic resources. The agricultural sector has traditionally played a large role in the economy, contributing around EC$86.92 million to Gross Domestic Product since 2006.

Approximately 7% of the total labour force is engaged directly or indirectly in the fishing industry, which creates employment for an estimated 2,500 fishers and more than 500 others in supporting services. Approximately 1.8 million pounds of fish is landed annually, of which 0.2 million pounds is exported.

Marine-based tourism is a key sector for employment and revenue generation. The favourable location, good conditions and picturesque scenery of the Grenadines and Tobago Cays in particular, attract sailors from around the world. By 2009, over 70% of the 270,952 visitors to the country were reported to have arrived by sea, comprising 149,462 cruise ship visitors and 40,859 yachting visitors.

Threats to Biodiversity

In recent years serious infrastructural, socio-cultural and ecological problems have contributed to the declining quality of the land-based, coastal and marine biodiversity in St. Vincent and the Grenadines. The threats to terrestrial biodiversity are both natural and anthropogenic.

Natural threats include weather phenomena such as storms, hurricanes and drought, along with the potential effects of global climate change, disease, impacts of invasive alien species, endemism and small population size of local species By way of example, in December 2013 a Low Level trough system affected the islands completely destroying approximately 5% (800 ha) of the forest and damaging another 15 %. The total effect of the weather system on the agricultural sector was estimated at EC $32,398,175 million, of which the forestry sub-sector accounted for 74.1%.

Drought causes soil deterioration and loss, and encourages the spread of thorn-bearing and other non-palatable plants that can withstand the drought, even encroaching into non-traditional habitats such as wetlands.

The endemic species on St. Vincent and the Grenadines are all vulnerable, in varying degrees, to extinction due to their very narrow geographical range, small population sizes, and low population densities. Small populations have a

greater tendency towards extinction due to loss of genetic variability, fluctuations in genetic and environmental factors, and/or natural catastrophes.

Extensive studies of diseases and their effects on local terrestrials have not been conducted. However, documentation exists on diseases that affect the St. Vincent Parrot. Of these, Avian tuberculosis is currently one of the greatest health concerns. Plants are also susceptible to pests and diseases. The mahogany shoot borer pest (*Hypsipyla grandella),* for example, causes significant damage to local mahogany (*Swietenia* spp.) plantations.

Anthropegenic threats are the most numerous and include the following:

- Global climate change
- Habitat destruction and modification due to inappropriate land clearance for agriculture, fuel wood, illegal cultivation and settlement, and development in coastal areas
- Exotic and invasive alien species—marine (lionfish and seaweed) terrestrial (Cuban tree frog and love vine), floral and faunal—which negatively impact both biodiversity and the nation's food and nutrition security.
- Potential impacts of the introduction of genetically and living modified organisms
- Unsustainable agricultural practices such as shifting cultivation and inappropriate use of agricultural chemicals
- Unregulated land use due to lack of enforcement of land use planning legislation
- Insufficient and/ lack of implementation of environmental policy and legislation
- Tourism development without appropriate measures taken to mitigate negative environmental impacts

- Intensive grazing, in particular species selective grazing
- Unregulated and illegal harvesting of already threatened species of both terrestrial and marine flora and fauna
- Bush fires
- Pollution – land-based and marine
- Poverty – which creates and intensifies pressure on biodiversity
- Limited environmental awareness
- Limited biodiversity research

Status of Implementation of the NBSAP and Mainstreaming Biodiversity Conservation

Implementation of the NBSAP for the period 2000 to 2010 was assessed as less than satisfactory; it was not used to inform planning in key sectors, and most of the activities recommended in the various priority areas were not done.

There is still no comprehensive legislation to implement the Convention on Biological Diversity. Progress has been made, however, in the form of the National Parks (Amendment) Act 2010, and preparation of additional draft legislation including Regulations (2011) to the Forestry Resources Conservation Act, a draft Environmental Health and Management Act (2013) and EIA Regulations (2015) under the Town and Country Planning Act, 1992.

An institutional review and strengthening for biodiversity management has not yet been done. There are plans, however, to restructure the institutional framework by creating a Department of Health and Environmental Management to formalise the current situation, and this is supported by the draft Environmental Health and Management Act.

No monitoring programmes to maintain a continuous record of the current and changing status of biological resources, other than the Amazona guildingii parrot, have been established. However, this is recognised by all as a priority

area and several programmes are on stream to prepare for such monitoring, particularly in the marine environment.

No inventories of the quantities, locations and habitats of marine and terrestrial biodiversity have been conducted, except for a few species populations, due to lack of resources. Similarly, there have been no carrying capacity studies. In 2008 a central national GIS was established within the Physical Planning Department and protocols for data-sharing are being developed. The inventory of biodiversity resources is needed to provide the requisite data with which to populate the GIS.

While a number of different agencies have their discreet educational programmes, a harmonised biodiversity education programme is still a clear necessity. For this and other priority areas, human resource development is a constant priority and an on-going challenge due to the constraint of financial resource confronting the country.

Finally, although many policies and plans exist that in some way incorporate biodiversity conservation; this has not resulted in effective mainstreaming. A comprehensive strategy for mainstreaming biodiversity, including a plan for monitoring its implementation, is a necessary component of the next NBSAP.

The 2011-2010 Aichi Biodiversity Targets in Relation to National Biodiversity Targets and National Development Goals

The Strategic Plan for Biodiversity 2011-2020 and the twenty Aichi Biodiversity Targets were adopted by the Conference of the Parties to the Convention on Biological Diversity in 2010 at Nagoya, Japan. The 11th Conference of the Parties urged Parties to develop national targets, using the Strategic Plan for Biodiversity 2011–2020 and the Aichi Targets as a guiding framework, and integrate their National Biodiversity Targets into National Biodiversity Strategy and Action Plans in accordance with national priorities and capacities.

St. Vincent and the Grenadines have now selected those Aichi Targets on which they would base their National Biodiversity Targets. The Aichi Targets are 1, 5, 9, 11 and 15, and the National Targets are as follows:

National Target 1

By 2020, at least 50% of the population of St. Vincent and the Grenadines is knowledge-able about the values of biodiversity and the steps they can take to conserve and use it sustainably. *The same as Aichi Target 1*

National Target 2

By 2020 St. Vincent would have completed studies to quantitatively establish the status of all natural habitats and the rate of habitat loss, including forest, and would have developed and in the process a strategy to reduce the rate of habitat loss. *Adaptation of Aichi Target 5*

National Target 3

By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment. *The same as Aichi Target 9*

National Target 4

By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes. *The same as Aichi Target 11*

National Target 5

By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification. *The same as Aichi Target 15*

These selected targets relate to Goal 4 of the National Economic and Social Development Plan 2013 -2025, which is:

> ***Improving physical infrastructure, preserving the environment and mitigating the impact of climate change***.

Four specific objectives under this Goal4 are relevant to the National Biodiversity Targets, namely:

Objective 4.1: To optimise the use of limited land space.
Objective 4.7: To conserve the natural resources of the country through effective utilisation and management.
Objective 4.8: To ensure a clean, safe and healthy environment.
Objective 4.10: To reduce the adverse impact of climate change.

Actions are recommended to integrate the National Biodiversity Targets and these National Development Objectives in the areas of:

- Public education and awareness of the importance of biodiversity conservation
- Quantitative research on the status of all natural habitats
- The control or eradication of invasive alien species
- Effective conservation and equitable management of significant terrestrial, coastal and marine ecosystems
- Restoration and conservation of ecosystem resilience, thereby contributing to climate change adaptation and mitigation

CHAPTER ONE

Biodiversity Status and Trends

St. Vincent Parrot *Amazona guildingii*, Photo courtesy Ministry of Tourism

Marcgravia umbellata, Photo by L. Culzac-Wilson

Soil Conservation Techniques at Argyle, St. Vincent
Photo courtesy Nicholas Stephens

Coral reef in Bequia, Photo by K. Baldwin

1.0 INTRODUCTION

St. Vincent and the Grenadines is an archipelagic State in the Eastern Caribbean. The country, with a population estimated at 120,000, is located approximately 61° west and 13° north. It lies approximately 1,508 miles (2,427 km) south of Miami (Florida), 415 miles (667 km) north of Venezuela and 109 miles (175 km) east of Barbados.

The main island, St. Vincent, is located to the north of the island archipelago (See Fig. 1.) The Grenadines, a chain of 32 islands and cays, lie to the south, between St. Vincent and Grenada. Seven of the Grenadine Islands are inhabited and include Bequia, Mustique, Canouan, Mayreau, Union Island, Palm Island and Petit St. Vincent. The total land area is 150 sq. miles (389 km^2) of which the main island is 133 sq. miles (344 km^2).

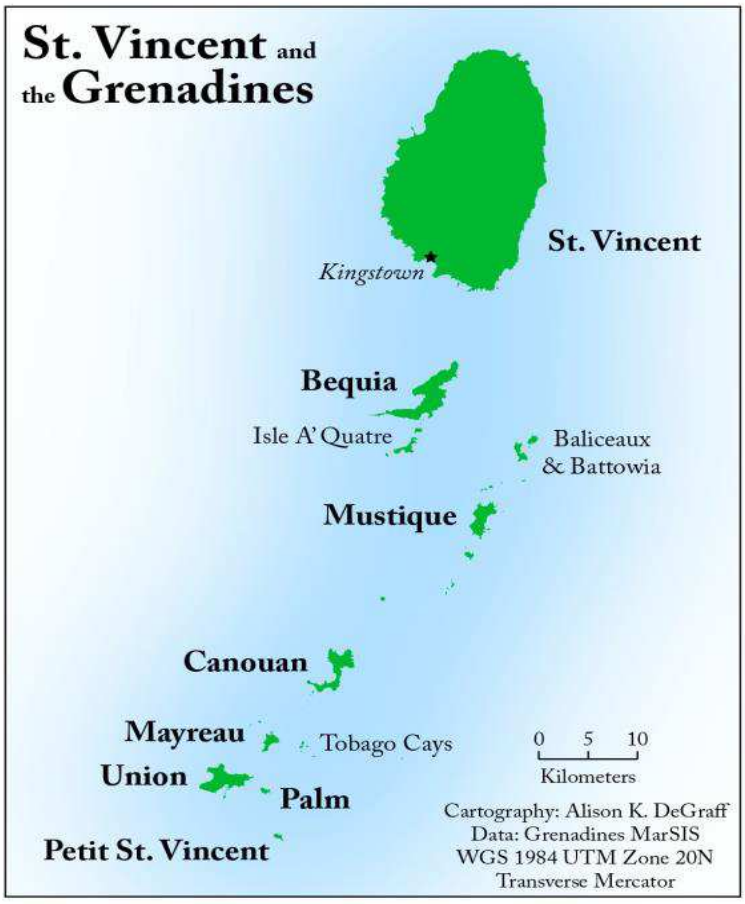


Figure 1. Location of St. Vincent and the Grenadines

(http://www.islandtimeholidays.com/Map_of_Caribbean_and_St._Vincent_and_the_Grenadines.htm)

St. Vincent and the Grenadines has a territorial sea of 12 nautical miles and an Exclusive Economic Zone (EEZ) and continental shelf of 200 nautical miles. The marine space is over 70 times the land area. The terrain of the main island and several of the Grenadines is mountainous (Ministry of Finance, Planning and Economic Development, 2013). The highest point, La Soufriere (4,048 ft/1,234 m), is located on the main island. An active volcano, La Soufriere, last erupted in 1979, causing tremendous damage to the agricultural sector and disrupting life, especially in the northern third of St. Vincent.

The climate is tropical marine, characterised by an average annual temperature of 27° Celsius due to the moderating influence of the ever-present trade winds. There is a marked dry season from mid-December to mid-May, and a rainy season from mid-May to mid-December. In the drier months, higher than normal atmospheric pressure results in dryness and drought conditions in coastal areas. The wet season is characterised by tropical waves, depressions and hurricanes. Hurricanes are perennial hazards related to the atmospheric conditions of the region in the wet season.

The rainfall distribution is quite reliable on the mainland of St. Vincent. It is highest in the north central portion of the island (150 inches) and decreases on the coast (about 60 inches). The leeward side of the island is in a "rain shadow" and shows marked variation in rainfall compared with the windward side. The well-watered interior provides the source of the country's potable supply of water and for hydroelectricity power generation on the Colonarie, Cumberland and Richmond Rivers (Ministry of Finance, Planning and Economic Development, 2013).

1.1 Biodiversity Status and Trends

Biological diversity - or biodiversity - is the term used to refer to the variety of life on Earth and the natural patterns it forms. It refers to the wide variety of ecosystems and living organisms: animals, plants, their habitats and their genes. The biodiversity we see today is the fruit of billions of years of evolution, shaped by natural processes and, increasingly, by the influence of humans. It forms the web of life of which we are an integral part and upon which we depend.

Biodiversity is extremely complex, dynamic and varied. Its innumerable plants, animals and microbes physically and chemically unite the atmosphere (the mixture of gases around the earth), geosphere (the solid part of the earth), and hydrosphere (the earth's water, ice and water vapour) into one environmental system which makes it possible for millions of species, including humans, to exist. Yet, human activity in particular is causing the extinction of animal, plant and microbial species at rates that are a thousand times greater than those which would have occurred naturally (Wilson l992), approximating the largest extinctions in geological history.

The current vegetative cover of St. Vincent and the Grenadines is the result of natural and man-made activities that have occurred over centuries, and correlates highly with its topography, elevation, geology and rainfall. The diverse physical features and climatic conditions of the islands have resulted in a variety of ecosystems such as forests, grasslands, wetlands, coastal and marine ecosystems which harbour and sustain high biodiversity and contribute to human well-being but are increasingly under threat from a variety of sources – natural and man-made.

St. Vincent and the Grenadines became a signatory to the United Nations Convention on Biological Diversity (UNCBD) in 1992. Under this Convention, countries are required to submit to the UNCBD Secretariat annual national reports on the status, trends and threats to their biodiversity as well as national strategies for its management and conservation.

1.1.1 Agricultural and Domesticated Biodiversity

The agricultural efforts in St. Vincent and the Grenadines have historically focused on both crop and livestock production and, in a majority of farming operations, mixed farming was the dominant production strategy used (Barker, 2009).

The country's climatic conditions and rich volcanic soil combine to provide a fertile environment for over 70 agricultural commodities (Landell Mills Ltd., 2008), including vegetables, fruit trees and ground provisions, and livestock including cows, sheep, goats and pigs. Some agricultural livestock also serve as pets and include guinea pigs (*Cavia porcellus)*, rabbits (*Lepus curpaeums)*, ducks (*Anas* sp.) and guinea fowl (Numididae). Domesticated animals include dogs (*Canis* sp.) and cats (*Felis catus)*.

1.1.1.1 Crop Diversity

Local crop diversity is expressed through the variation in the genetic and phenotypic characteristics of the agricultural plants. During the pre-colonial period, the indigenous peoples were subsistence farmers cultivating cassava, sweet potatoes and pineapples and harvesting a variety of fruits from the forests, which were still virtually intact. This practice then gave way to commercial plantation agriculture where one crop was dominant for a period and huge sections of the forests were cleared for that purpose.

St. Vincent and the Grenadines had a succession of crops beginning with tobacco and followed by cotton, sugarcane, coconuts, arrowroot and bananas. The land use pattern which emerged thereafter was one where permanent crops occupied 67% of the agricultural land, temporary crops 27%, and pasture and forage 6% (Ministry of Agricultural, 2000). In recent years, however, circumstances have changed considerably.

The dominance of the banana (for uncooked fruit) is being replaced by root crops such as dasheen, eddoes, tannias, yams, sweet potatoes, and cassava. A wide genetic base supports the production of these crops (Food and Agricultural Organization – FAO, 2008). There are several cultivars/accessions for some of these species. For example, farmers can identify the smooth "Barbados-tannia" in contrast to the rough "fire-round-the-wall" traditional cultivar. Distinction is also made between "bitter" and "sweet" cassava based on the proportion of cyanic acid it contains, but within each group there are several cultivars/accessions. Similarly, there are about 9 cultivars of yams, and more than 50 accessions of sweet potatoes being grown throughout the country.

Arrowroot is a root crop that merits special mention due to its traditional Vincentian connection but whose production has shown wide swings resulting in decrease in acreage and starch production over the last decade. Despite its potential, this crop has a very narrow genetic base. The "creole" and "banana" varieties are still the only ones evidenced in the field.

The perennial tree crops and major fruits fall roughly into two groups. Those varieties that originated in the tropical Americas and those introduced from outside this region. The obvious pattern is a narrower genetic base for introductions such as coconut, breadfruit, citrus, mango, and a wider diversity in the genetic base of indigenous papaya, pine-apple, passion fruit, avocado, and annonas (soursop, sugar apple, star apple, sapodilla) (FAO, 2008).

Notwithstanding the above statement, there are several varieties of coconuts which fall into the two categories of the "Panama Tall" and the "Malayan Dwarf". Captain Bligh introduced several varieties of breadfruit which are still seen in the landscape, and there are several cultivars of oranges, tangerines, grapefruits, limes and lemons. The mango group makes for an interesting study with the variety of "colourful" localized names such as "Miss Nelly", "food", "starch", "scuttle" and even "glass window"; but there are some preferred varieties for the export market among which are the "Julie" and "Palawi".

There is a group of under-utilized fruits, medicinal plants, herbs and condiments that has the potential to be developed into important industries. These include bitter aloe (*Aloe vera* L), bois bande (*Richeria grandis)*, christophene (*Sechium edule)*, wild yam or bobas (*Dioscorea* sp.), sea grapes (*Coccoloba uvifera* L), fat pork (*Chrysobalanas icaco* L), dunks plum (*Ziziphus mauritiana* L), plumrose (*Syzygium malaccanse* - Gaertn) and guava (*Psidium guajava)* (Food and Agricultural Organization, 2008). Cocoa (*Theobroma cacao)*, nutmeg (*Myristica* sp.), coffee (*Coffea* spp.) and clove (*Caropyllus oramaticum)* are among the spices or condiments with some potential. So too are cashew (*Anacardium occidentale)*, tamarind (*Tamarindus indica)* and *Macadamia* spp.

The cocoa has become a crop of interest in the agricultural diversification programme. Up to 2013, financial investments were being made by the international company, Amajaro Trading. Old cacao fields and trees were rehabilitated and some new varieties introduced from Trinidad. This effort is currently being led by the St. Vincent Cocoa Company and the Cocoa Producers Cooperative.

Most of the under-utilized plants can be seen growing as single trees while there are a few very small stands scattered across the country, with the exception of the cocoa and nutmeg which are established in small to medium-sized plots. St. Vincent and the Grenadines has been a minor exporter of nutmeg to Canada for many years. Cocoa beans are currently processed as part of a growing cottage industry. Similarly, coffee is grown, processed and sold as gourmet food by a single producer.

1.1.1.2 Medicinal Plants

Plants are important, locally, in treating several ailments including coughs, colds, fever, dysentery and headaches. Over 150 agricultural and non-agricultural species comprise the medicinal plants recorded for St. Vincent and the Grenadines. The growth in demand for alternative medicine

presents a major opportunity for the provision of locally produced health and herbal products (Landell Mills Ltd., 2008).

1.1.2 Animal and Plant Genetic Diversity

Animal and plant genetic diversity is managed primarily through conservation of species, habitats and ecosystems. There is currently no *in situ* conservation of wild crop relatives and wild plants for food and agriculture. Examples of in-situ species conservation efforts include the establishment of reserves and protected areas for animals such as the St. Vincent Parrot (*Amazona guildingii)*.

Ex-situ species conservation efforts include captive breeding of the St. Vincent Parrot at the Nicholl's Wildlife Complex located in the Botanical Gardens. Other initiatives include the work done by the Botanical Gardens, the Taiwan Mission, the Caribbean Agricultural Research and Development Institute (CARDI) and the Ministry of Agriculture, Forestry and Fisheries (MAFF). They maintain *ex situ* collections of plant genetic resources, including some collections that are important for food and agriculture such as sweet potato, cassava, pitaya, pineapples, herbs and spices, banana, plantain, citrus, avocado, guava, papaya, plumrose, mango, Indian jujube, golden apple, coconut, carambola and wax apple.

1.1.2.1 Biotechnology Activity in St. Vincent and the Grenadines

With the signing of the Cartagena Protocol on Biosafety in 2000[1], numerous countries have prepared National Biosafety Frameworks which detail the status of biotechnology in the respective country and provide for the safe handling of living modified organisms derived from modern biotechnology. St. Vincent and the Grenadines deposited its instruments of ratification of the Cartagena Protocol on August 27, 2003.

Much of the biotechnology activity in St. Vincent and the Grenadines relates to the agricultural sector and specifically to plants. As a result, the lead institution involved in biotechnology is the Ministry of Agriculture, Forestry and Fisheries (MAFF). The Biotechnology Laboratory of the MAFF has been mandated to research and implement biotechnology-related priorities and policies. There is also collaboration with international and regional agencies such as the Food and Agricultural Organisation (FAO) and CARDI, and some bilateral assistance such as the Agriculture and Horticulture Development

[1] Cartagena Protocol on Biosafety to the Convention on Biological Diversity was signed 15 May 2000, but became effective on 11 September 2003, seeks to protect biological diversity from the potential risks posed by genetically modified organisms resulting from modern biotechnology.

Project implemented through the Taiwan International Cooperation and Development Fund. Biotechnology activities are described in below.

Propagation and Multiplication

The primary focus of the Biotechnology Laboratory's programmes is on tissue culture for the production of high quality and disease-free materials for the banana and horticultural industries (United Nations Environment Programme/Global Environment Facility 2011). It is geared towards the introduction or development and multiplication of new varieties that are high yielding, that can produce at a level that would impact positively on the nation's food import bill while promoting healthier eating habits, and that can counteract the anticipated impacts of climate change on agriculture in the country. In addition, new cultivars of various crops have been introduced to combat the impacts of plant disease (FAO, 2008).

Propagation is focused, therefore, primarily on traditional food crops such as taro, bananas, sweet potato, cassava, and yam, with some propagation of ornamentals as well. Fruits such as the mango, citrus and avocado are propagated by budding and grafting, while the pineapple (FAO, 2008) banana, cassava, dasheen, pineapple, plantain, sweet potato, tannia and orchids are propagated by tissue culture (Lynch, 2013). Table 1 shows the products of tissue culture plantlet production over the period 2006 to 2010. There is some micro-propagation[2] of the English potato and the Biotechnology Laboratory of the MAFF is also working with the International Atomic Energy Agency (IAEA) on activities in mutation breeding[3] (Rohan McDonald, pers. comm.).

Table 1. Tissue Culture Plantlets Production 2006 - 2010

Crop Plants	No. of Plantlets	Direct Revenue (XCD)
Banana	428 945	2 144 725
Cassava*	3 000	15 000
Dasheen	147 921	739 605
Orchids	19 669	98 345
Pineapple	164 634	823 170
Plantain	5 145	25 725
Sweet Potato**	12 439	62 195
Tannia	76 965	384 825
TOTAL	**858 178**	**4 293 590**

* Two years ** One year – 2010

[2] Micropropagation is the production of a large number of individual plants from a small piece of plant tissue cultured in a nutrient medium.

[3] A joint FAO/International Atomic Energy Agency Programme in Nuclear Techniques in Food and Agriculture conducts extensive research in plant genetics, including Mutation Enhanced Technologies for Agriculture.

Source: Lynch (2013) with data from the Ministry of Agriculture Biotechnology Laboratory at Orange Hill

Importation of Genetically Modified Products

Importation of new species occurs through bilateral, regional and international activities, including importation of pest resistant species (MAFF, pers. comm. 2013). In addition, St. Vincent and the Grenadines has become a net importer of food, including products that could possibly be genetically modified and products from countries known to produce genetically modified food crops (Lynch, 2013). The Ministry of Agriculture recognises the need to establish protocols to monitor this importation for potential impacts on local species and on wider biodiversity; consequently, the procedures for doing so are currently being developed (ibid.).

1.1.3 Endemism

To date, St. Vincent and the Grenadines has recorded some 14 endemic animals (Table 2) and 19 endemic plants (Table 3). Additionally, 29 regionally endemic tree species are listed. Five mammals are Lesser Antillean endemics, two of which are restricted to Grenada and St. Vincent and the Grenadines, while 3 reptiles are also restricted to the region.

Table 2. Endemic Fauna of St. Vincent and the Grenadines

Faunal Type	Scientific Names	Local Names	Comments
Birds			
	Amazona guildingii	St. Vincent Parrot	IUCN Vulnerable
	Catharopeza bishop	Whistling Warbler	IUCN Endangered
Mammals			
	Oligoryzomys victus	St. Vincent Pygmy Rice Rat	Extinct
	Micronycteris buriri	St. Vincent Big-eared Bat	Endemic
Reptiles			
	Anolis griseus	Saint Vincent Tree Anole	Endemic
	Anolis trinitatus	Saint Vincent Bush Anole	Introduced to Trinidad
	Chironius vincenti	St. Vincent Black Snake	Endemic
	Corallus cookii	Congo Snake; Cook's Tree Boa	Endemic
	Gonatodes daudini	Grenadines Clawed Gecko	Endemic
	Sphaerodactylus kirbyi	Bequia Dwarf/Pygmy Gecko	Endemic
	Corallus grenadensis	Grenadine Boa	Endemic
Amphibians			
	Pristimantis shrevei	St. Vincent Whistling Frog	Endangered (IUCN)

Source: Maclean, et-al., 1977; Caribbean Conservation Association, 1991; Simmons and Associates, 2000; Culzac-Wilson, 2008; de Silva and Wilson, 2006; Treglia, 2006; Powell and Henderson 2007).

Table 3. Endemic Flora of St. Vincent and the Grenadines

Floral Type	Scientific Names
Flowering Plants	
	Trigynaea antillana
	Meliosma herbertii
	Calliandra guildingii
	Psidium guildingianum
	Gustavia antillana
	Tibouchina cistoides
	Begonia rotundifolia
	Hoffmannia tubiflora
	Malouetia retroflexa
	Columnea speciose
	Peperomia cuneate
	Peperomia vincentiana
	Croton guildingii
	Epidendrum vincentinum
	Tillandsia megastachya
Ferns	
	Cyathea tenera
	Pteris longibrachiata
	Asplenium godmani
	Acrostichum smithii

Source: Caribbean Conservation Association 1991

Two of the country's mammals are endemic, one of which, the St. Vincent pygmy rice rat (Oligoryzomys victus), has become extinct. Reptiles are the largest group of endemics, 7 of which are recorded, while only one endemic amphibian is currently known (refer to Table 2 for a full list of endemic fauna). A number of other regionally endemic birds, mammals, reptiles and amphibians are also found on the islands. St. Vincent and the Grenadines contains part of the Caribbean's Key Biodiversity Hotspot.

1.1.4 Terrestrial Biodiversity

St. Vincent and the Grenadines has recorded over 1,150 species of plants and 163 species of ferns, including 15 endemic flowering plants and 4 ferns (Caribbean Conservation Association, 1991). In terms of animals, all five groups of vertebrates are represented including 7 species of amphibians, over 20 species of reptiles, 170 species of birds, 22 species of mammals, and 516 species of marine biodiversity (Ministry of Health, Wellness and Environment, 2010). These, along with thousands (and perhaps millions) of invertebrates (of which approximately 500 have been identified), contribute

to the islands' faunal diversity, and provide a wide range of ecosystem and ecological services for the country.

1.1.4.1 Forests

In 1982, the World Resources Institute determined that St. Vincent and the Grenadines possessed some of the largest examples of relatively unaltered tropical rain forests and cloud forests in the Lesser Antilles (Ivor Jackson and Associates, 2004). Most of St. Vincent's natural forest is found in the island's conservation corridor in the central mountain range. The forest inventory completed in 1993 indicated that the total forestland area was approximately 12,683 ha and consisted of primary rainforest (4,306 ha), secondary rainforest (3,450 ha), dry scrub woodlands (2,178 ha). Table 4 shows the distribution of vegetation types by area occupied.

Table 4. Vegetation Types of St. Vincent and the Grenadines by Area, 1993

Vegetation type	Area (Ha) – Approx.
Primary Rainforest	4,306
Secondary Rainforest	3,450
Dry Scrub Woodlands	2,178
Palm Brake Forest	518
Elfin Woodland	457
Regenerated Areas	1,775
Mangrove	70
Plantations	142
TOTAL ACREAGE	12,869

In 2004, it was estimated that the islands contained about 31,500 acres (12,748 hectares) of tropical forests representing approximately 29% of the land area. Natural forest constituted about 70% of this area with planted forest and agro-forest representing about 25% and 5%, respectively (Ivor Jackson and Associates, 2004). In the absence of recent comprehensive forest inventory, forest cover is currently estimated at between 25% and 30% (pers. comm. between F. Providence and L. Culzac-Wilson). These estimates suggest relatively consistent forest coverage between 1993 and 2004, compared to an apparent decline since 2004. They also highlight the need for a comprehensive inventory to establish trends in changes in forest cover.

In the Grenadines there are few areas of natural forest cover, as unrestricted grazing and physical development, particularly due to housing and tourism-related construction (hotels, guest houses, etc.), have resulted in widespread loss of vegetative cover. Littoral woodland covers small areas of the islands.

Generally, there is concern in St. Vincent and the Grenadines for the current status of the island's forest. Forest loss is estimated to be at a rate of 3 - 5% annually due primarily to encroachment of banana cultivation and illegal farming (Ivor Jackson and Associates, 2004).

1.1.4.2 Forest Plantations

The Forestry Department continues its reforestation efforts within upper and middle watershed areas, with the aim of increasing forest cover for soil and water conservation. Examples of such efforts include the reforestation of unstable lands and those unsuitable for agricultural activity within the 3,860-acre Cumberland Forest Reserve with the aim of preserving forest, protecting against sedimentation and, in collaboration with the St. Vincent Electricity Services, improving the overall hydroelectric potential of the watershed. Further, reforestation efforts in the Montreal Watershed resulted in reduced land slippage and soil erosion and water sedimentation. In the past, reforestation efforts were concentrated in areas reclaimed from agricultural activity, particularly on Crown lands and forest reserves. Today the focus is also on areas reclaimed from marijuana farming.

Mahogany *(Swietenia macrophylla* and *S. Mahagoni)*, and Blue Mahoe *(Hibiscus elatus)* are the prime species planted in reforestation activities. There is also a thrust towards establishing mixed plantations and agroforestry stands. This allows for the inclusion of indigenous forest species and agricultural crop trees (agroforestry) in the reforestation efforts. Chief indigenous species used include Galba (*Calophyllum antillanum)*, Penny Piece (*Pouteria multiflora)*, Sweetwood (*Lauracea* spp.), Fiddlewood (*Citharexylum spinosum) and* Greenheart (*Chlorocardium rodiei)*.

Exotic and indigenous plantations help to meet increasing demand for local timber, poles, fuelwood, charcoal and handicraft species. Their production, however, has been a low priority because planting efforts were committed to 'protection' rather than 'production' forests. Some 142 hectares of plantations have been established by the Forestry Department under its reforestration programme and are primarily located in Cumberland, Perserverance and Vermont Valleys (Pers. comm. between C. Lyttle and L. Culzac-Wilson, 2014).

1.1.4.3 Fauna

Birds

St. Vincent and the Grenadines have recorded over 170 bird species (see Appendix 1), 95 of which breed on the islands. The country holds regionally and globally important populations of a number of birds. These include 14 of the Caribbean's 38 Lesser Antilles Endemic Bird Area Restricted-Range birds.

Two of the 14 restricted-range birds, St. Vincent Parrot (*Amazona guildingii)* (Figure 2) and Whistling Warbler (*Catharopeza bishopi)* (Figure 3) are endemic to the island of St. Vincent.

Figure 2. St. Vincent Parrot (*Amazona guildingii*)
Courtesy Ministry of Tourism

Figure 3. Whistling Warbler (*Cartharopeza bishopi*)
Courtesy Ministry of Tourism

The *Amazona guildingii* is the country's national bird and an important national symbol for conservation (see Box 1). The Lesser Antillean Tanager (*Tangara cucullata)* (Figure 4) and the Grenada Flycatcher (*Myiarchus nugatory)* (Figure 5) are restricted to St. Vincent and Grenada. A subspecies of rufous-throated solitaire (*Myadestes genibarbis siblans)* is endemic to St. Vincent, as is a subspecies of house wren (*Troglodytes aedon musicus)* (Figure 6) (Culzac-Wilson 2008).

Figure 4. Grenada Flycatcher (Tqangara culculatta)
Photo courtesy Tourism Department

Figure 5. Lesser Antillean Tenager (Myarchus nugatory)
Photo courtesy Tourism Department

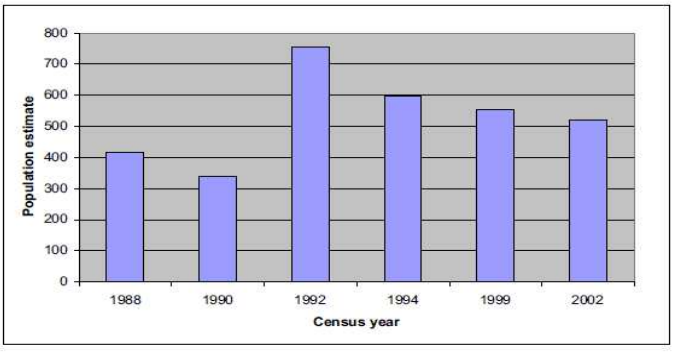
Figure 6. St Vincent House Wren (Triglodytes aedon)
Photo courtesy Tourism Department

Box 1. The St. Vincent Parrot – A Flagship for Conservation

The St. Vincent Parrot *Amazona guildingii* is St. Vincent and the Grenadines' national bird. It is listed under Appendix 1 of the Convention for the International Trade in Endangered Species of Flora and Fauna and as "*vulnerable*" on the International Union for Conservation of Nature (IUCN) Red Data List. These listings have been primarily due to the bird's small population, limited island range, the ever-present threat of hurricane and volcanic activities which have in the past proved to be detrimental to the population, and the threats of continued loss and fragmentation of habitat and ongoing trade in the species (Culzac-Wilson 2005). Although biennial population censuses show that the population is relatively stable with an estimated 700 individuals (Forestry Department, pers. comm.), these issues mean that the population may always be considered vulnerable (Culzac-Wilson 2005).

The species is confined to mature rainforests between 125 and 1,000 m, mostly in the upper reaches of the Buccament, Cumberland, Colonarie, Congo-Jennings-Perseverance and Richmond Valleys, though birds do stray into nearby farmland and plantations to forage. In 1987, the 4,400-ha St. Vincent Parrot Reserve was established to protect the species, and in 2005 a 5-year Species Conservation Plan was developed for the bird. There is an ongoing captive breeding programme for the parrot at the Nicholl's Wildlife Complex in the Botanic Gardens (Culzac-Wilson 2005). Regular populations censuses between 1988 and 2006 revealed that the population was stable to increasing, and the current estimate of over 700 birds in the wild (Forestry Department, pers. comm. with Lystra Culzac-Wilson). As a flagship, its conservation (particularly through the establishment of the Parrot Reserve) affords protection to many other forms of biodiversity.

Figure 2: Population census of wild *Amazona guildingii*, 1988 - 2006



Six globally threatened species, which include the whistling warbler and St. Vincent Parrot, have been recorded from the islands. The other four include the critically endangered Eskimo curlew (*Numenius borealis)*, near threatened buff-breasted sandpiper (*Tryngites subruficollis)*, near threatened Caribbean coot (*Fulica caribaea)*, and the near threatened piping plover (*Charadrius melodus)* (Culzac-Wilson, 2008).

St. Vincent and the Grenadines supports populations of 76 species of waterbirds, including seabirds. Three species of seabird breed on St. Vincent: the white-tailed tropicbird (*Phaethon lepturus)*, roseate tern (*Sterna dougallii)* and brown noddy (*Anous stolidous*). An additional 9 species nest on uninhabited or undisturbed islets in the Grenadines. The current breeding status of the Audobons Shearwater (*Puffinus lherminieri)* in the country is unknown, although it has certainly bred locally in the past (Culzac-Wilson 2008b).

Extensive surveys of seabird breeding colonies were conducted in St. Vincent and the Grenadines by Environmental Protection in the Caribbean (EPIC) during 2009–2010. A total of 28 seabird nesting sites were identified in the Grenadine islands (Lowery *et al*., 2009). The most important island for breeding birds, based on diversity of species and the number of large colonies, is Battowia. Bullet Cay at Battowia also supports over 250 nests of sooty terns (Figure 7).

Figure 7. Sooty Terns on Petit Canouan
Courtesy K. Baldwin

Petit Canouan is also of significant importance, supporting two regionally important populations including the largest colony of sooty terns, bridled terns and brown noddies. The islands surrounding Mustique (North Rocks, The Pillories, Rabbit and Brooks) support a diverse population of breeding seabirds

including the largest colony of roseate terns in the area, the second largest colonies of laughing gulls and brown noddies (Pillories) and the third largest colony of bridled terns, as well as a small colony of brown and masked boobies.

Mammals

The country has recorded over 22 species of terrestrial mammals (see Table 5). This number excludes agricultural and domestic species. Bats are the largest group of recorded mammals, of which the St. Vincent big-eared bat (*Micronycteris buriri)* is a recently described endemic. The other endemic mammal, the St. Vincent pygmy rice rat (*Oligoryzomys victus)* is believed to be extinct.

Table 5. Mammals of St. Vincent and the Grenadines

Scientific Name	Local Name	Status
Oligoryzomys victus	St. Vincent Pygmy Rice Rat	Endemic; Extinct
Dasyprocta agouti	Agouti	Partially protected
Herpestes auropunctatus	Mongoose	Vermin
Didelphis marsupialis	Opossum; Manicou	Partially protected
Dasypus novemcinctus	Armadillo; Tattoo	Partially protected; Considered a repti-mammal
Rattus rattus	Rat	Vermin
Rattus norvegicus	Rat	Vermin
Mus musculus	Mouse	Vermin
Allicronycteris megalotis	Bat	Vermin
Ardops nichollsi luciae	Bat	Vermin; Antillean Endemic
Artibeus jamaicensis	Jamaican Fruit Bat	Vermin
Artibeus lituratuspalmarum	Bat	Vermin; Probably quite rare Endemic to Grenada and St. Vincent and the Grenadines
Artibeus schwartzi schwartzi	Bat	Vermin
Brachyphylla cavemarum cavemarum	Bat	Vermin; Antillean Endemic
Glossophaga longirostris rostrate	Long-nosed Bat	Vermin
Micronycteris buriri	St. Vincent Big-eared Bat	Vermin; Endemic
Molossus molossus	Free-tailed Bat	Vermin
Monophyllusplethodon luciae	Bat	Vermin; Antillean Endemic
Noctilio leporinus mastivus	Bat	Vermin
Pteronotus parnellii	Bat	Vermin
Sturnira lilium paulsoni	Bat	Vermin; Endemic to Grenada and St. Vincent and the Grenadines
Tadarida brasiliensis antillularum	Bat	Vermin

. Source: Simmons and Associates 2000; de Silva and Wilson 2006

Note: Bats are currently listed as 'Vermin' in the Wildlife Protection Act. However, due to increased recognition about their importance in the environment, discussions are currently taking place to have them removed from this category (Forestry Department pers. comm. with Lystra Culzac-Wilson.

Reptiles

There are over 18 species of terrestrial reptiles known for St. Vincent and the Grenadines (Table 6). These include 6 endemic species, and one recent invasive. Two of the endemics, *Anolis trinitatis* and *M. Bruesi,* have been introduced elsewhere in the West Indies - *M. bruesi* to Barbados and *A. trinitatis* to Trinidad (Powell and Henderson, 2007).

Four species of endangered sea turtles are known to occur in St. Vincent and the Grenadines. These include one species of endangered turtle, green *Chelonia mydas* and three critically endangered species, leatherback *(Dermochelys coriacea)*, hawksbill *(Eretmochelys imbricate)* and the loggerhead *(Caretta caretta)* turtles. Juvenile and sub-adult hawksbill and green turtles forage in coral reef and seagrass habitats, respectively, throughout the year but non-nesting adults are rare (Dow *et al*., 2007). Green turtles are generally more abundant in the Grenadine Islands than around St. Vincent, perhaps reflecting the distribution of seagrass and algal beds. Hawksbills appear to be less common than green turtles nationwide (L. Edwards pers. comm. with K. Baldwin). Leatherbacks are non-resident; seasonal sightings (primarily March-July) are generally of gravid females (L. Edwards personal communication). A total of 51 sea turtle nesting beaches have been identified, of which 24 are on the mainland and the remaining 27 are spread across the Grenadine Islands (Dow *et al*., 2007; Baldwin, 2012).

Table 6. Reptiles of St. Vincent and the Grenadines

Scientific Name	Local Name	Global Status	Location in St. Vincent and the Grenadines
Anolis griseus	Saint Vincent Tree Anole	Endemic to St. Vincent	St. Vincent
Anolis trinitatus	Saint Vincent Bush Anole	Endemic to St. Vincent Introduced to Trinidad	St. Vincent
Chironius vincenti	St. Vincent Black Snake	Endemic to St. Vincent	St. Vincent
Corallus cookie	Congo Snake; Cook's Tree Boa	Endemic to St. Vincent	St. Vincent
Gonatodes daudini	Grenadines Clawed Gecko	Endemic to Union Island in the Grenadines	Union Island
Sphaerodactylus kirbyi	Bequia Dwarf/Pygmy Gecko	Endemic to Grenadines	Bequia; Mustique Thought to be endemic to Bequia
Ameiva ameiva	Zagada; Ground Lizard	Endemic to St Vincent and Grenada	St. Vincent; Bequia; Mustique; Canouan; Union Island; Mayreau
Anolis aeneus	Bronze Anole	Grenada and the Grenadines, Trinidad and Tobago, Guyana	Bequia; Prune Island; Battowia; Baliceaux; Mustique; Union Island; Tobago Cays; Mayreau; Catholic Island

Scientific Name	Local Name	Global Status	Location in St. Vincent and the Grenadines
			Petit Canouan; Savan Island; Petit Mustique
Anolis richardi	Lizard		Bequia
Anolis sagrei	Brown Anole	Recent introduction to St. Vincent and the Grenadines (invasive)	Extent unknown
Bachia heteropa	Earless Worm Lizard		Bequia; Mustique; Canouan
Caretta caretta	Loggerhed Turtle		
Chelonia mydas	Green Turtle		
Corallus grenadensis	Grenadine Boa	Endemic	Bequia; Mustique; Battowia
Dermochelys coriacea	Leatherback Turtle		
Eretmochelys imbricate	Hawksbill Turtle		
Geochelone carbonaria	Red-footed Tortoise; Morocoy	Widespread CITES II	St. Vincent; Mustique; Canouan Union Island
Gymnophthalmus underwoodi	Snake Servant	Regional Endemic	St. Vincent; Bequia; Mustique
Hemidactylus mabouya	Woodslave; Common House Gecko		St. Vincent; Bequia; Mayreau
Iguana iguana	Iguana	Widespread	Most Islands
Mabuya mabouya	Shine Lizard		Canouan; Mayreau
Mastigodryas bruesi	Grass Snake	Endemic to St Vincent and Grenada Introduced to Barbados	St. Vincent; Bequia; Mustique; Battowia
Sphaerodactylus vincenti vincenti	Least Gecko	Endemic subspecies	
Thecadactylus rapicauda	Turnip-tailed Gecko	Mexico, Caribbean, South America	St. Vincent; Bequia; Mustique
Unknown – Awaiting research results	Tantilla Snake	Recently found on Mustique and not fully identified	Mustique

Source: Maclean, *et al.* 1977; Caribbean Conservation Association, 1991; Simmons and Associates, 2000; Culzac-Wilson, 2008; de Silva and Wilson, 2006; Treglia, 2006; Powell and Henderson 2007).

Terrestrial Invertebrates

A number of studies on the invertebrate fauna have been undertaken. The existence of endemic species and their status, however, is not well known (Miller & Miller, 1989 in Chow, 1993). Work by Schwartz and Henderson (und.), Simmons and Associates (2000), Jackson (2004) and more so, the recent work by de Silva and Wilson (2006) have provided further information on these creatures.

To date, 25 species of diplopods (centipedes and millipedes), 220 species of arachnids (not including microscopic mites), 2,000 species of insects, and 35 terrestrial crustaceans have been recorded in the country. Furthermore, some 875 species of molluscs (75 terrestrial and aquatic, 800 marine) are

known to exist. 16 species of nematodes have been recorded for Union Island alone.

Amphibians

Seven species of amphibians are recorded in St. Vincent and the Grenadines as in Table 7.

Table 7. Amphibians of St. Vincent and the Grenadines

Scientific Name	Local Name	Status	Location
Rhinella marina (formerly Bufo marinus)	Cane Toad	Introduced	**St. Vincent and the Grenadines**
Eleutherodactylus johnstonei	Lesser Antillean Whistling Frog	Introduced	**St. Vincent**
Pristimantis shrevei	St. Vincent Whistling Frog	Endemic Endangered (IUCN)	**St. Vincent**
Eleutherodactylus martinicensis	Frog		**St. Vincent**
Leptodactylus wagneri	Frog	Widespread	**St. Vincent, Bequia**
Leptodactylus validus	Ditch Frog		
Osteopilus septentrionalis	**Cuban Tree Frog**	**Alien Invasive**	**Mustique**

Source: Maclean *et al*. 1977; Caribbean Conservation Association, 1991; Simmons and Associates, 2000; Culzac-Wilson, 2008; de Silva and Wilson, 2006; Treglia, 2006; Powell and Henderson 2007).

1.1.4.4 Aquatic Biodiversity

The Caribbean Islands have more than 160 species of freshwater fish, about 65 of which are endemic to one or a few islands. A lack of in-depth studies has restricted the quality and quantity of information available on this topic. However, research such as that conducted by Anthony (1997) in the Buccament Valley revealed that rivers were teaming with fish, crayfish and crabs (Table 8). Twenty-five species have been identified and include gobies (Gobiidae), mountain mullets, tri-tri *Sicydium* sp., clingfish (Gobiesocidae), crabs and crayfish. The mullet, tri-tri and crayfish are the most popular for domestic consumption.

Table 8. Aquatic Fish and Crustaceans Found in Buccament Valley

Scientific Names	**Common Name**
Ayta innocous	Booky man
Cardisoma guanhumi	Pasture crab
Coenobita clypeatus	Hermit crab
Epibulocerca sp.	River crab
Guinotia dentate	Mountain crab
Macrobrachium carcinus	River lobster
Macrobrachium faustimum	Crayfish
Macrobrachium heterchinus	Crayfish
Agonostomus monticola	Mountain mullet
Gobisox sp.	Goby
Mugli cephalus	Mullet
Sicytium plumieri	Goby
	Sand grouper

Source: Anthony, 1997

1.1.5 Coastal and Marine Biodiversity

The coastal and marine habitats of St. Vincent and the Grenadines provide a substantial abundance of biodiversity. These habitats include seagrass and lagoons, areas of mangrove and a variety of patch, fringing and bank barrier reefs (Eastern Caribbean Natural Area Management Programme – ECNAMP, 1980; Economic Commission for Latin America and the Caribbean – ECLAC, 2004) (Figure 8).

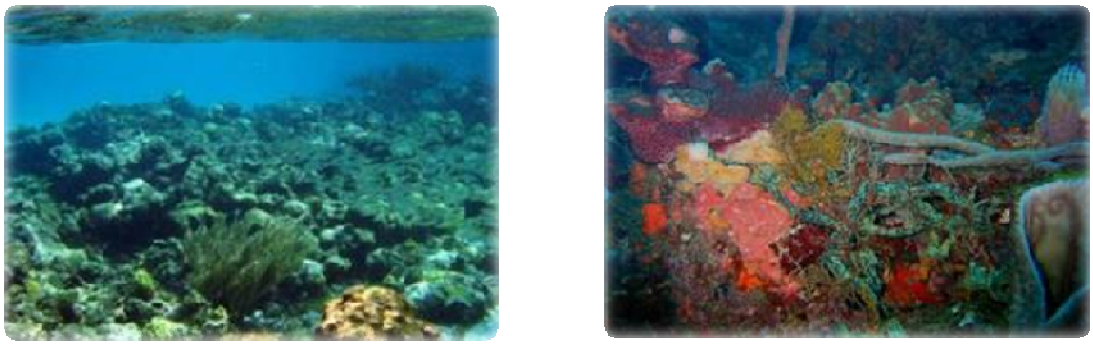


Figure 8. Reef Habitats Typical of St. Vincent and the Grenadines. Courtesy K. Baldwin (2012)

Detailed information on the distribution and abundance of coastal and marine habitats is lacking for the mainland of St. Vincent. The majority of reef-related habitats, and subsequently dive sites, on mainland St.Vincent are located on the south-eastern coastal shelf and the leeward coast. Three quarters of the Grenada Bank (2,000 km^2) is shallower than 60m and supports the most extensive coral reef and related habitats in the south-eastern Caribbean (Caribbean Conservation Association – CCA, 1991).

As a result of the Marine Resource and Space-use Information System - MarSIS[4], there is extensive information on the abundance and distribution of the coastal and marine habitats, resources and space-uses of the Grenadine Islands. From 2006 to 2012, a participatory geographical information system approach was employed as a conceptual framework to integrate conventional biophysical and management information with the practical knowledge of marine resource users (Baldwin 2012). MarSIS estimates that habitats including a total of 42,469 ha of reef, 67,633 ha reef-related habitat

[4] The Grenadines Marine Resource and Space-use Information System (MarSIS) is a project of the Centre for Resource Management and Environmental Studies (CER%MES), University of the West Indies, Barbados, developed in association with the NGO: The Sustainable Grenadine, Inc. (SusGren). See www.grenadinesmarsiss.com.

(mixed live bottom), 1,472 ha of seagrass, 13,571 ha hard bottom and 10,970 ha sand, are provided by marine environment of the Grenadine islands.

1.1.5.1 Wetlands and Mangroves

Wetland ecosystems are primarily comprised of mangrove forests. They are rich in terrestrial and marine biodiversity as they provide a complex of important habitat for a variety of birds, while also providing a safe haven for juvenile fish. Mangrove forests protect coastal areas and built environments from storm surges and flooding, especially during hurricanes and tsunamis. Furthermore, mangroves provide numerous ecosystem services that include slowing water flow, and trapping and recycling sediments and organic matter, while also acting as a biological filter able to break down a variety of heavy metals and nutrients.

Figure 9. Red Mangroves at Topion Bay, Union Island. *By Kim Baldwin*

Mangroves are important as they play a large role in carbon sequestration (the capturing and storing of carbon), sequestering five times as much carbon as rainforests. St. Vincent and the Grenadines contains a total of 69.34 ha of mangrove forest, comprising primarily buttonwood (*Conocarpus erectus*), red (*Rhizophora mangle*) (Figure 9), white (*Laguncularia racemosa*) (Figure 10), and black (*Avicennia germinans*) mangrove species (MarSIS, 2012; TNC, 2013; Baldwin, 2014).

Figure 10. White Mangroves (Laguncularia racemosa) at Brighton, St. Vincent. Courtesy Forestry Department

Mangrove stands (Table 9) are found on the mainland of St. Vincent (Brighton Beach, Canash, Sion Hill and Blue Lagoon) as well as the Grenadine islands of: Bequia (Industry Bay, Ravine Bay, Friendship Bay, Jetty Bay), Isle de Quatre (Mahault Bay), Mustique (Lagoon and Salt Pond near Airport), Canouan (eight small Littoral stands of Buttonwood), Mayreau (Salt Pond), the Tobago Cays (Petit Bateau and Petit Rameau) and Union Island (Ashton Lagoon,

Belmont Salt Pond, Richmond Bay, Queensberry Point, Sand Bay, Frigate Island, Topion Bay, and Diablo).

Table 9. Mangroves of St. Vincent and the Grenadines Listed by Island, Area (Hectares), Species and Type

Island	Area (Ha)	Type	Species
St. Vincent	1.32	Fringe, Littoral	Buttonwood, White
Bequia	1.89	Littoral, Fringe	Buttonwood, Red
Isle Quatre	12.18	Littoral	Buttonwood
Mustique	9.62	Basin	Red
Canouan	6.85	Littoral, Fringe	Buttonwood, Red
Mayreau	0.53	Basin	Red
Tobago Cays	2.31	Fringe, Littoral	Red, White, Buttonwood
Union Island	34.64	Fringe, Littoral, Basin	Red, Buttonwood

Source: Baldwin 2012; Baldwin 2014

Salt ponds, of which mangroves are typically the dominant vegetation, form a vital buffer zone between terrestrial and marine ecosystems. Contaminants such as sediment, nitrates and phosphates are filtered out by salt ponds before they can reach the ocean. The depth, salinity and overall chemistry of ephemeral salt ponds fluctuate depending on temperature, rainfall, and anthropogenic influences such as nutrient runoff. Salt pond habitat also serves as a vital feeding and breeding ground for shore birds. There are a number of salt ponds in both St. Vincent and the Grenadines with an estimated area of 97.64 ha (MarSIS, 2012; Baldwin, 2014). Owia, located on the north-eastern coast of the mainland, has been developed as a tourism site and is a designated Recreational Area under the National Parks and Protected Areas Systems Plan 2010-2014.

1.1.5.2 Fisheries

Exploited fisheries resources consist of demersals including shallow-shelf reef fishes, deep-water slope and bank reef fishes, lobsters and conchs, and inshore and offshore pelagic species including robins, jacks, dolphin fish, barracuda, tunas and sea turtles (Adams, 1970 and 1972; Mahon, 1990). There is also a fishery for blackfish (short-finned pilot whales and other cetacean species) occurring in Barrouallie. Under the International Whaling Commisssion aboriginal subsistence whaling provisions, St. Vincent and the Grenadines has a quota of four humpback whales. These occur in Bequia.

As seen throughout the Caribbean, overfishing has depleted many of the fish stocks, particularly conch, lobster and reef fish species (Ginsberg, 1994; Jardine and Straker, 2003). Other factors impacting fish stocks include habitat loss due to physical development and associated pollution (Price and Price, 1998), illegal unreported and unregulated fishing from foreign

vessels (McCalla, 2013), and more recently from invasive species such as lionfish (Isaacs, 2012).

Table 10 provides a description of each of the various fisheries, stock status, current regulations and objectives for management. Available scientific data (Mahon, 1990; FAO, 2002; Caribbean Fisheries Information System, 2011) as well as anecdotal reports, all indicate that demersals have been harvested beyond sustainable yield for many years. Likewise, the most highly priced fish species, the Caribbean spiny lobster, has been fully or over-exploited in the Grenadines (Headley and Singh-Renton, 2008). The export of queen conch declined in the 1980s, and was subsequently linked to overfishing (Mohammed *et al*., 2003). In response, the government is trying to promote the exploitation of the deep slope demersal and offshore pelagic fisheries (FAO, 2002; Caribbean Fisheries Information System, 2011).

Table 10. Regulations and Management Objectives of Various Fisheries in St. Vincent and the Grenadines

Fishery	Status of stock	Current regulations	Management objectives
Shallow shelf demersals	Overexploited	No spear fishing in marine conservation areas	Promote stock recovery Divert effort to deep-slope demersals and offshore pelagics
Deep slope demersals	Underexploited	No spear fishing in marine conservation areas	Maximise catches with in Maximum sustainable yield Reduce illegal fishing by foreign vessels Protect stock from overfishing by limiting effort Improve the collection of catch and effort data
Inshore pelagics	Moderately exploited	Net mesh size restrictions Use of trammel nets are illegal	Encourage co-management Maintain artisanal nature of the fishery
Offshore pelagic	Underexploited	None	Cooperate with International Commission for the Conservation of Atlantic Tunas to assess and preserve the resource Promote the wise development of commercial and sport fisheries by controlling effort
Lobster	Overexploited	Size restrictions (3.5 inches) Closed season from (1st May to 31st August) Illegal to catch / sell out of season Illegal to remove eggs from berried lobsters	Rebuild stocks in depleted areas Proper management by controlling effort is needed to ensure sustainable extraction
Conch	Overexploited	Size restrictions (7 inches) Minister can declare any period as a closed season	Manage sustainably and prevent further resource depletion by controlling fishing effort

Source: (Food and Agriculture Organization 2002).

1.1.5.3 Seaweed Mariculture

Presently the only mariculture activities (Figure 11) in the country are for seamoss. Two species, *Gracilaria terete* and *Eucheuma,* are grown in two locations in the Grenadines: Topion Bay, outside of Ashton, Union Island and Saline Bay, Mayreau (Rincones 2011). Although there is no aquaculture of fish species, the Fisheries Division is interested in pursuing the development of fish aquaculture as a potential investment opportunity for the country (Fisheries and Aquaculture Policy 2012).

Figure 11. Seaweed Mariculture in Topion Bay, Union Island (Ashton Multi-purpose Cooperative) Photo by Kim Baldwin

1.2 Importance of Biodiversity and its Implications for Human Wellbeing

Biodiversity is the foundation of life on Earth. It is crucial for the functioning of ecosystems which provide us with products and services without which we could not live. Oxygen, food, fresh water, fertile soil, medicines, shelter, protection from storms and floods, stable climate and recreation - all have their source in nature and healthy ecosystems. But biodiversity gives us much more than this. We depend on it for our security and health; it strongly affects our social relations and gives us freedom and choice.

Every Vincentian depends on biodiversity for their survival. Rural communities in particular depend directly on biodiversity for food, fuelwood and shelter. Thousands more obtain indirect benefits through recreational and cultural activities, and through the use of heritage sites.

Human well-being is the welfare and quality of life that people experience as a result of the consumption of goods and services (Proença and HM Pereira, 2011). Human well-being is strongly dependent on cultural-socio-economic processes, as well as on the provision of services from the environment. St. Vincent and the Grenadines is a Small Island Developing State (SIDS) with all the inherent challenges, such as a narrow economic base and high vulnerability to external shocks and natural disasters. According to the 2011

United Nations Human Development Report ranking, St. Vincent and the Grenadines is recorded as having High Human Development.

The environment provides a wide variety of services that benefit human wellbeing. These positive benefits or eco-services include food, fuel, water, protection from floods, protection from soil erosion, medicines, carbon sinks and others. These "ecosystem services" are predominantly public goods since they provide external benefits which are non-excludable - they have no markets and no prices. Biodiversity itself is not an eco-service, but it results in the provision of eco-service to people.

1.2.1 The Commercial Value of Biodiversity

The country's diverse endowment of biological resources has played a large role in the provisioning services such as the availability of high quality food, potable water and touristic resources that have historically played a large role in the country's economy. The benefits from the provisional services are typically quantifiable since they include goods and services traded in formal markets (See Table 11.).

Table 11. Gross Domestic Product by Economic Activity at Basic Prices, in Current Prices: 2009 - 2013 (EC$ Million)

SECTOR	2009R	2010R	2011R	2012	2013 Prel
Agriculture, Hunting & Forestry	99.35	104.06	108.88	108.37	109.02
Crops	77.87	86.39	87.74	89.16	88.86
Bananas	6.94	4.83	0.49	0.81	1.03
Other Crops	70.93	81.56	87.25	88.35	87.84
Livestock	20.47	16.69	20.17	18.27	19.23
Forestry	1.01	0.98	0.96	0.94	0.92
Fishing	8.51	7.75	7.24	6.93	7.93
Private Households with Employed Persons	4.29	4.58	4.74	4.75	4.79
Less FISIM	19.23	21.00	19.05	20.94	17.94
Gross Value Added at Basic Prices	1,525.92	1,556.47	1,555.91	1,593.53	1,642.14
GROWTH RATE	-2.85	2.00	-0.04	2.42	3.05
Taxes on products	*297.38*	*284.36*	*271.4*	*279.38*	*273.77*
Less Subsidies	*1.15*	*1.52*	*1.1*	*0.95*	*1.08*
GDP at Market Prices	1,822.15	1,839.31	1,826.21	1,871.96	1,914.83
GROWTH RATE	-2.95	0.94	-0.71	2.51	2.29

Source: St. Vincent & the Grenadines Statistical Office /Eastern Caribbean Central Bank (ECCB)

1.2.2.1 Agriculture and Food Supply

The agricultural sector has traditionally played a large role in St. Vincent. In 2006, agriculture contributed EC$86.92 million to Gross Domestic Product (GDP), a contribution that remained relatively unchanged up to 2010.

Up until 2000, banana production was the main economic activity in the agricultural sector. It created jobs— providing up to 60% employment in rural areas—and was the main revenue earner for the country. The bulk of banana output was geared for export, especially to the European market. However, banana cultivation was unsustainable. Large areas in the forest were cleared away to facilitate the cultivation of this one crop.

The lack of flora diversity, the removal of forest cover, soil erosion, and the persistence of agricultural diseases and pests, led to the gradual decline in productivity and output from banana plantations. Table 12 shows the decline in banana exports between 2005 and 2010. Currently other crops, particularly root crops, are the main contributors to agriculture.

Table 12. Banana Exports 2005 - 2010

Period	UK market		REGIONAL market (Caricom)		TOTAL BANANA EXPORT	
	Quantity (Tonnes)	Value (EC$)	Quantity (Tonnes)	Value (EC$)	Quantity (Tonnes)	Value (EC$)
2005	18,137	23,956,851	7,074	8,103,904	25,211	32,060,755
2006	18,370	22,977,477	3,038	4,565,353	21,408	27,542,830
2007	18,393	22,241,949	3,624	5,578,819	22,017	27,820,768
2008	11,695	11,324,974	7,974	9,123,200	19,669	20,448,174
2009	8,215	10,415,296	10,123	10,736,688	18,338	21,151,984
2010	4,672	7,890,676	4,267	5,890,602	8,939	13,781,278
Total	**79,482**	**98,807,223**	**36,100**	**43,998,566**	**115,582**	**142,805,789**

Source: Statistical Unit, Ministry of Agriculture

Apart from banana, small scale farmers in St. Vincent and the Grenadines also cultivate a number of other crops. These include root crops (aroids, cassava, yam and sweet potato), fruit bearing vegetables (tomato, okra, eggplant, cucurbits, sweet pepper), leafy and flower bearing vegetables (cabbage, lettuce, cauliflower, broccoli, pat-choi), fruits (mango, coconut, citrus, pineapple, guava, avocado, wax apple, breadfruit) and vegetables with edible roots and tubers (carrot, radish and beet). However, the potential

of these crops is not fully utilized. They are produced primarily for domestic food consumption.

Faunal biodiversity is also used for food provisioning services. Citizens of St. Vincent and the Grenadines have traditionally reared sheep, goats, cattle, poultry, ducks and pigs alongside their crops, and have hunted wild animals such as the iguana (*Iguana iguana)*, armadillo or tattoo (*Dasypus novemcinctus)*, agouti (*Dasyprocta agouti)* and opossum or manicou (*Didelphis marsupialis)*. Mixed farming practices complement the yield of both crops and livestock. Livestock and "wild meat" have been used as a source of food for households and to supplement income.

Apiculture (bee-keeping) is another provisioning service that is obtained directly from biological resources. Though there were several challenges affecting this industry prior to 2006, mainly due to the varroa mite (*Varroa jacobsoni)*, financial aid and technical assistance from the European Union helped to increase colony and honey production (see Table 13).

Table 13. Apiculture Production 2006 - 2013

DESCRIPTION	2006	2007	2008	2009	2010	2011	2012	2013
Colonies	24	38	80	168	210	420	424	**477**
Honey Prod. (gallons)	**0**	**50.4**	**204.4**	**868**	**1134**	**950.8**	**1748**	**1153.8**

Food provisioning services are also acquired from the sea. According to Jardine and Straker (2003), fish landings were about 1,134 tonnes annually and the contribution of fishing to the St. Vincent and the Grenadines' annual Gross Domestic Product (GDP) was 1.7%. While seemingly insignificant, fishing is actually worth more than this value suggests as GDP calculations do not take into account the importance of fishing as a source of employment or its contribution to food security and to other sectors such as tourism (Kirby-Straker 2003)

1.2.1.2 Fisheries

It is estimated that approximately 7% of the total labour force is engaged directly or indirectly in the fishing industry, with most of them depending solely on fishing for their livelihood (FAO, 2002). It creates employment for an estimated 2,500 fishers and more than 500 others are employed in supporting services, including vending, trading, marketing, boat repair, or boat building services.

Fish is also a valuable trade commodity: total exports from St. Vincent and the Grenadines in 2000 amounted to 175 tonnes with a value of approximately US $1 million. Lobster and tuna are extremely important export species representing 75% of St. Vincent and the Grenadines' total export value (FAO, 2002). Approximately 1.8 million pounds of fish is landed annually and approximately 0.2 million pounds of fish exported annually (Landings Data 2007-2011). Table 14 below indicates the commercial value of some fisheries.

Table 14. Description of Fisheries in St. Vincent and the Grenadines (Adapted from CRFM 2012).

GROUP	DESCRIPTION
Offshore Pelagics	These are fast swimming migratory fish that inhabit the deep sea. Species include tuna, billfish, dolphin, kingfish. These species contribute approximately 20.5% of the total estimate of fish landed over the five year period (0.4 million pounds annually), realizing annual value of 3.2 million EC dollars.
Inshore Pelagics	These are near shore fish found in mid water or surface water in sheltered bays. They are generally smaller than offshore pelagics, e.g. jacks, robin, dodger. On average these species contribute approximately 45% of the landings to the local market (0.83 million pounds annually), realizing an annual value of 2.9 million dollars.
Demersals	These are fish dwelling at the sea bottom, e.g. rock hind, blem (queen snapper), groupers, parrotfish. These species contribute approximately 18% (0.34 million pounds annually) to the local market, realizing an annual value of 2.9 million dollars.
Shellfish	Shellfish are marine species usually living at the sea bottom and protected by a shell. E.g. lobster, conch. Approximately (0.055 million pounds) of lobster are exported annually (Headley and Singh-Renton 2008) and (0.005 million pounds) of conch (CMP 2008). Average annual contribution to landings is 3.5% (0.064 million pounds) with an average value of 0.7 million dollars. However, shell fish contribute an estimated 24% to average annual exports.
Sharks	Sharks are fast swimming migratory fish that inhabit the deep sea and have a cartilaginous skeletal structure. Sharks are not particularly targeted in the fishery, however, by catch could be significant especially in the longline fishery. Estimate annual landing for shark is less than 18,000 pounds contributing about 1% of landings to the local market.
Turtles	Turtles are reptiles that spend the majority of their lives at sea. However; the females come on land to lay their eggs. Marine sea turtles are primarily taken opportunistically by fishers. Estimated annual landings are 20,000 pounds. Poaching and catches out of season would probably contribute to this figure being higher.
Whales and Porpoises	These marine mammals are migratory, or pelagic in the case of porpoises. They give suckle to their young e.g. humpback whales and blackfish. There is a traditional significance with respect to the harvesting of marine mammals in St. Vincent and the Grenadines. Humpback whales are targeted in Bequia while the pilot whale and other porpoises are targeted in Barrouallie and by some Kingstown fishers.

Data Source: Fisheries Division Data Unit 2007 - 2011

1.2.1.3 Tourism

Biodiversity plays different roles in different types of tourism. Coasts, mountains, rivers and forests are major attractions for tourists around the world. Wildlife and landscapes are important attractions for tourism in mountain areas. Biodiversity is a direct attraction at the heart of nature-based tourism products – such as wildlife watching, scuba diving or tourism in protected areas (World Tourism Organization, 2010). All tourism, even in city centres, relies on natural resources for supplies of food, clean water and other 'ecosystem services' that ultimately depend on biodiversity.

Tourism in the Caribbean focuses strongly on the recreational opportunities provided by their coastal environments. In St. Vincent and the Grenadines, since the 1990s, the advent of a tourism boom attracted many people away from fishing into tourism-related jobs such as in the construction and hospitality industries (Chakalall *et al*., 1994). The industry showed strong signs of growth during the 1995-2006 period, but declined in 2007(see Figure 12).

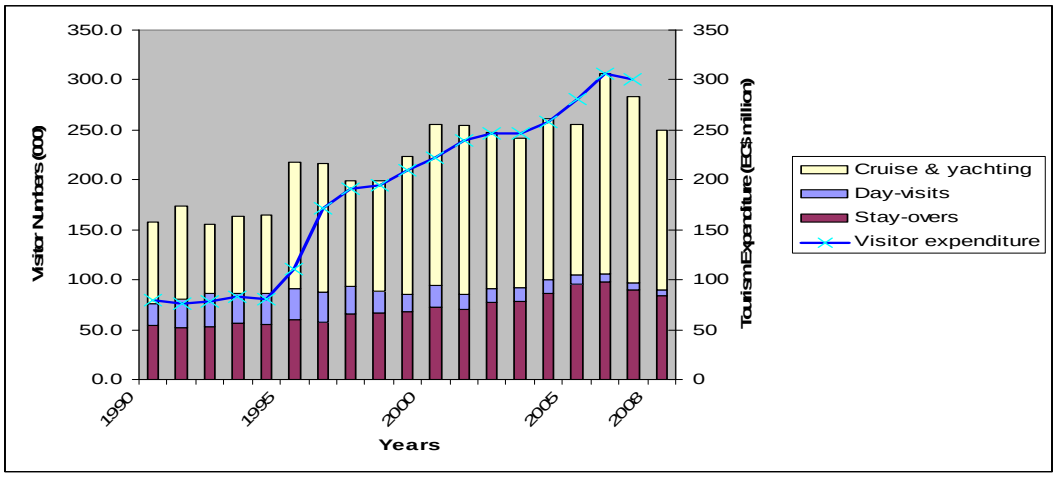


Figure 12. St. Vincent and the Grenadines Tourist Arrivals (1990 - 2010)
Source: Mc Donald (2010)

Marine-based tourism is a key sector for employment and revenue generation, and development is proceeding apace with the number of visitors to the Grenadines increasing steadily in recent years (ECLAC, 2004; CTO, 2010). This sector includes onshore accommodation and restaurants (resorts, hotels, guesthouses, rental villas), ferries, cruise-ships and yachts (including bareboat, charter and live-aboard cruisers), and recreation/entertainment (water-sports including SCUBA and snorkel trips, sport-fishing, day boat charters).

The favourable location, good conditions and picturesque scenery of the Grenadines and Tobago Cays in particular, attract sailors from around the world; an estimated 84% of yachts visiting the Grenadines make a stopover there (ECLAC, 2004). According to Baldwin (2012), there are five charter yacht companies, seven dive shops and 22 day tour operators. In addition, by 2009, over 70% of the 270,952 visitors to the country were reported to have arrived by sea, comprising 149,462 cruise ship visitors and 40,859 yachting visitors (CTO, 2010). Marine tourism now provides a large amount of foreign exchange, employment and additional revenue from taxes and expenditure (ECLAC, 2004; CTO, 2010).

1.2.1.4 Ecosystem Services

Regulatory and supportive services are acquired from the forest and coastal ecosystems. Rainforests play a key role in protecting soils, intercepting precipitation, reducing floods, and maintaining soil fertility. The genetic diversity in rainforests plays a critical role in nutritional diversity. The diverse range of biological organisms living in the soil performs a number of vital functions such as decomposition of litter and cycling of nutrients such as nitrogen.

Mangrove forests slow water flow, thereby enhancing sediment deposition and filtration. They act as a natural sink for a variety of sediment, nitrates, heavy metals and nutrients. The salt ponds of mangrove forest filter out contaminants from water before they reach the ocean and also serve as a feeding and breeding ground for birds and a number of marine species. Mangrove forests form a vital buffer zone that protects coastal areas from erosion and storm surge especially during hurricanes, are also rich in biodiversity.

Coral reefs in the Grenadines serve as a habitat to a multitude of different species of fish, invertebrates and sea mammals. Reefs provide a location for spawning, nursery, refuge and feeding for marine organisms. The high fish population within reefs makes them a productive area for fishing. Coral reefs also act as a buffer to reduce the impact of waves. To some extent, they may protect beaches from erosion, especial when storms occur. As supporting services, they facilitate biological reproduction, biochemical processing, waste assimilation and preservation of biological diversity.

Faunal species such as bats and birds play a critical role in the pollination of fruit trees and other plants. Bats and birds eat insects, and other forms of biodiversity can also be used to naturally control pest in agricultural areas.

CHAPTER TWO

Threats to Biodiversity

Soil Conservation Techniques at Argyle, St. Vincent
Photo courtesy Nicholas Stephens

2.0 INTRODUCTION

In recent years serious infrastructural, socio-cultural and ecological problems have contributed to the declining quality of the landbased, coastal and marine biodiversity in St. Vincent and the Grenadines. The threats to terrestrial biodiversity can be divided into two main categories – natural and anthropogenic. As nature would have it however, these two categories often work simultaneously and, when they do, their impacts are multiplied several-fold.

2.1 Natural Hazards and Threats to Terrestrial Biodiversity

Historically, the islands have been known to be affected by heavy rainfall, hurricanes, earthquakes, volcanic eruptions and drought, on their own or in combination. These, coupled with the islands' steep topography and erosion-prone soils, have had devastating effects on biodiversity. Other natural threats include the effects of global climate change, disease, impacts of invasive species (including competition and depredation), endemism and small population size. These threats are examined in the following sections.

2.1.1 Volcanic Eruptions, Hurricanes and Drought

St. Vincent and the Grenadines lies within the hurricane belt and is at risk from hurricanes annually during the period June to November. The island also has an active but dormant volcano that last erupted in 1979. While little has been documented in recent times on the effects of storms and other natural disasters on local flora and fauna, published works and documentation by Clark (1905), Low (1972), Nichols (1980), Lambert (1983), Butler (1988) and the Forestry Department of St. Vincent and the Grenadines (2010-2011) give some insight into the devastation that they can have. The majority of this type of data is available for the St. Vincent Parrot which is among the most studied fauna on the country. Regarding volcanic and hurricane activity, Lambert (1983) stated that "The hot ash and toxic gases associated with eruptions have a direct detrimental effect on parrots and other wildlife."

Hurricanes and extreme weather events can also cause significant loss of vegetation and habitat (Butler, 1988) (see Figures 13 and 14). Clarke (1905) described the effects of the hurricane of 1898 on the island's flora as follows: "… on the next day, the island appeared as if it had been swept by fire, there was not a leaf, nor green thing in sight."

Figure 14. Stormsurge Damage to Beachfront
Courtesy Forestry Department

Figure 13. Landslide as a Result of a Tropical Storm
Courtesy Forestry Department

In 2010, Hurricane Tomas left a trail of destruction on the agricultural industry, particularly bananas. It also caused severe damage to housing and other infrastructure, and to the natural vegetation. It was recorded as one of the worst storms in recent history.

On 24 December 2013, a Low Level trough system affected the islands of Dominica, Saint Lucia and Saint Vincent and the Grenadines. Approximately 5% (800 ha) of the forest St. Vincent and the Grenadines was destroyed completely while 15 % of the forest was impacted but is expected to regenerate as part of the natural succession. The total effect of the weather system on the agricultural sector was estimated at EC $32,398,175 million, of which total damage was estimated at EC $**29.454 million** and total loss at EC $**2,943** million (Table 15). Of the total effect, the forestry sub-sector accounted for 74.1%, while total effect on the 'other crops', plantains and infrastructure was 6.9%, 5.8% and 5.3%, respectively.

Table 15. Financial Cost of a Low-level Trough on the Agricultural Sector (EC$)

	Total Effect 32,398,175		
Total Damage	**29,454,735**	**Total Loss**	**2,943,440**
Banana	280,640	**Banana**	171,755
Plantain	1,246,080	**Plantain**	656,680
Other Crops	1,700,595	**Other Crops**	546,400
Livestock	673,120	**Livestock**	200,315
Fisheries	223,300	**Fisheries**	160,350
Forestry	24,000,000	**Forestry**	0
Infrastructure	1,331,000	**Infrastructure**	393,940
Land Loss	0	**Land Loss**	814,000

Drought can also have detrimental effects on flora, although this may be only temporary. Its effects on fauna, however, might be more significant as whole populations within a given area may be weakened by dehydration or the absence of plant-based foods.

The effects of drought are particularly evident in the Grenadines (see Figure 15). During the dry season, soils become dry and cracked and a large majority of the vegetation turns brown. On islands such as Union Island, this period is known as the "let-go" season; that is, because of the scarcity of fodder brought on by desiccated soils, villagers are forced to release farm animals such as cows, goats and sheep, to forage for themselves. This causes further soil deterioration and loss as the animals which have been let loose, consume every last palatable plant within their reach. When the rains return, the absence of vegetation causes flash floods, soil erosion and leaching. These conditions have forced thorn-bearing and other non-palatable plants that can withstand the drought to become widespread and even encroach into non-traditional habitats, such as wetlands (see Exotic and Invasive Species – Section 2.2.3).

Figure 15. Effects of Drought on Union Island
Photo courtesy Martin Barriteau

2.1.2 Endemism and Small Population Size

By their very nature, the endemic species on St. Vincent and the Grenadines are all vulnerable, in varying degrees, to extinction. The reasons for this include the fact that they occur on small islands and generally have (1) a very narrow geographical range, (2) few populations, (3) small population sizes, and (4) low population densities (Primack, 2002). Further research may also reveal more species-specific vulnerabilities such as (1) declining populations, (2) requiring specialized niches, and (3) limited genetic variability. Small populations have a greater tendency towards extinction due to loss of genetic variability, fluctuations in genetic and environmental factors or natural catastrophes.

The St. Vincent Parrot, for example, presumably always had a small population (Butler, 1988). While the population is now at the largest it has been in recent history, its confinement to a small-island and a relatively fragmented ecosystem that is frequented by natural hazards and man-made

threats, could very well mean that the population will always be relatively small (Culzac-Wilson, 2005).

2.1.3 Disease

Infections by disease organisms are common in both wild and captive populations and can reduce the size and density of vulnerable populations. Disease organisms can also have a major impact on the structure of an entire biological community (Aguirre and Starkey, 1994; McCallum and Dobson, 1995; Daszak and Cunningham, 1999; Deem *et al*., 2001).

Extensive studies of diseases and their effects on local terrestrials have not been conducted. However, documentation exists on diseases that affect the St. Vincent Parrot, particularly populations. For example, Noegel *et al.* (1990) stated that these beautifully strong birds have a tendency towards obesity, dusty feather coats and a high incidence of lesions. Also, typical disease and viral infections known to affect or have potential to affect captive St. Vincent Parrots include Psittacine Proventricular Dilatation disease, avian tuberculosis varieties – *Mycobacterium genavense*, *M. avium*, *M. intracellulare* (de Soye *et al.,* 2002) and *M. tuberculosis* (B. Raphael pers. comm. to D. Bruning), Circovirus and Avian Polyoma virus (Crosta 2001), salmonellosis, Pacheco's disease and other herpes infections, and Psittacosis *Chlamydophilia psittaci* (Sweeney, und.). Avian tuberculosis is currently one of the greatest health concerns of holders of captive St. Vincent parrots (Culzac-Wilson, 2005).

Plants are also susceptible to pests and diseases. The mahogany shoot borer pest (*Hypsipyla grandella)* causes significant damage to local mahogany (*Swietenia* spp.) plantations. Mahogany is one of the most valuable tropical timber species in the world and *S. macrophylla* has been logged so heavily within its range that it is considered an endangered species and included in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Mahogany reforestation has been seen as an alternative that enables the reduction of logging pressures on the natural forest. Attack by the shoot borer has made efforts to grow prime commercial timber challenging.

2.2 Anthropogenic Threats

The major anthropogenic factors threatening biodiversity in St. Vincent and the Grenadines include global climate change, deforestation and habitat destruction, living and genetically modified organisms, hunting, poor agricultural practices and limited enforcement of existing legislation.

2.2.1 Global Climate Change

The potential impacts of climate change in the Caribbean include sea-level rise that threatens coastal habitats and human settlements, increased sea surface temperatures, warming and drying out of high altitude ecosystems, higher frequency and distribution of forest fires, the spread of tropical disease vectors, changes in agricultural productivity and impacts on coastal and watershed ecosystems. These changes will have major impacts on the region's rich biodiversity as well as on human health and livelihoods (The World Bank, 2008).

Specific studies of the impacts of climate change on terrestrial biodiversity in St. Vincent and the Grenadines are lacking. It is likely, however, that the impacts will exacerbate the damage that has already been caused by existing anthropogenic factors such as deforestation, poor agricultural and land-use practices, sedimentation and coastal pollution.

Vulnerability to the effects of climate change is greater in these tropical countries because agriculture, like other activities which are sensitive to climate change (such as hunting, fishing, tourism and forestry), occupies a more important place in national production. Temperatures, for example, are close to the limit of tolerance of commercial agriculture and it is therefore more difficult for these countries to adapt to and mitigate the impact of climate change, especially due to high costs and institutional shortcomings (Chavarria *et al*., 2009).

2.2.2 Habitat Destruction and Modification

Although all lands in St. Vincent and the Grenadines that lie above the 1000-ft contour were designated as Crown Lands since 1912, poor enforcement of this legislation has resulted in continued habitat loss and fragmentation (Culzac-Wilson, 2005). Today, clearance for agriculture, squatting, charcoal, and fuelwood continues to threaten several ecosystems. Since the 1993 forest inventory, the rate of deforestation occurring above the 305 metres contour boundary for crown land has continued at an alarming rate, as a result of cultivation of bananas, yams and dasheen,. Additional threats include the expansion of squatting in environmentally sensitive areas and clearing of relatively inaccessible lands in the interior (Figure 16) for illegal marijuana cultivation (Simmons and Associates, 2000; Woolcock, 2000). Koester, in 2001, estimated that there were some 1500 marijuana farmers occupying 3000 acres (1200 ha) of lands. Though there is no quantitative

data on the extent of loss of forest cover, it is quite possible that this number has significantly increased in recent times.

Figure 16. Forest Loss Due to Marijuana (Cannabis sp.) Cultivation
Photo courtesy Forestry Department

The fragmentation and degradation of habitats and ecosystems are making the country increasingly vulnerable to the impacts of natural disasters, including landslides, soil erosion and poor drainage of basins. The destruction of coastal and marine habitats stemming from unplanned coastal development (Baldwin, 2012), deforestation (including the cutting of mangroves) and sand or stone mining (United States Agency for International Development: Caribbean Open Trade Support, 2010), have resulted in widespread erosion and sedimentation and have increased the vulnerability of coastal communities' to the effects of climate change and related natural hazards such as hurricanes, tropical storms, storm surges and flooding (The Nature Conservancy, 2011).

2.2.3 Exotic and Invasive Species

The Caribbean, like the rest of the world, faces the challenge of the increased risk of the introduction and establishment of alien invasive species due to the increase in travel and trade (Caribbean Agricultural Research and Development Institute, 2009). Alien or exotic species are species that occur outside of their natural ranges because of human activity. These invasive

species may displace native species through competition for limited resources. Introduced animal species may prey upon native species to the point of extinction, or they may alter the habitat so that many natives can no longer persist (Primack, 2002). According to the International Union for Conservation of Nature – IUCN, (2014), today, alien invasion is second only to habitat loss as a cause of species endangerment and extinction.

A number of noted exotics are currently found throughout St. Vincent and the Grenadines. Recent introductions include the house sparrow (*Passer domesticus)*, brown anole (*Anolis sagrei)*, and Cuban tree frog (*Osteopilus septentrionalis)*. Invasive species are posing an increasing threat to marine biodiversity as well; specifically, the lionfish (*Pterois volitans; Pterois miles*) in 2011. Additionally, there have been rapid invasions of both the *Halophila stipulacea* seagrass (Willette *et al.,* 2013) and the *Ophiothela mirabilis* brittle star (K. Wilson, personal communication) in the coastal marine waters in recent years. The introduction of just one exotic species to an island may cause the local extinction of numerous native species (Primack, 2002).

The Cuban treefrog, which is native to Cuba, was recently discovered on the Grenadine island of Mustique (pers. comm.). The fact that this species is nocturnal has made its management and elimination very difficult and its population continues to increase and is becoming a nuisance. Cuban treefrogs eat a wide variety of other species including snails, millipedes, spiders, and a vast array of insects. They are predators of frogs and are cannibalistic. They are also known to eat lizards and even small snakes. This makes the Cuban treefrog a significant threat to local biodiversity.

The Mongoose (*Herpestes auropunctatus)* was introduced over a century ago as a biological control for rats and snakes on sugarcane plantations (see Table 16). However, the Mongoose itself soon became an invasive, preying on several native species (including birds), along with its intended targets. Examples of accidental introductions include rats (*Rattus* spp.) and the *Anolis sagrei* which is said to have come to these islands via white sand imported from Guyana (Forestry Department, pers. comm.). While little scientific research has been carried out on their effects locally, persons have observed the *A. sagrei* portraying aggressive behaviour towards local lizard species, and their presence in certain areas may be causing displacement of these natives (Forestry Department, pers. comm.). Furthermore, Treglia *et al*. (submitted) described a habitat shift in *A. trinitatis* at one locality where the two species are sympatric and which might be attributable to the presence of *A. sagrei* (*in* Powell and Henderson, 2007).

Table 16. Alien Invasive Species Introduced and Established in St. Vincent and the Grenadines

Pest/Disease	Year of Introduction	Crop Plant Affected & Impact	Management Strategy	Current Status
Sternochetus mangiferae (Mango Seed Weevil)	1995	Pest is affecting mangoes country wide. Loss of export market to the USA. Reduction in cultivation of mango.	Use of greasy traps around trunk of host trees, and removal of fruits. Field sanitation.	Pest is wide spread. No active implementation of management strategy.
Maconellicoccus hirsutus (Pink Mealy Bug)	1996	A number of crops were affected including soursop, sugar apple, sorrel, okra. Some ornamental and weed species were affected. Export trade to Barbados was temporarily suspended.	Introduction of two natural enemies: *Cryptolaemus montrouzieri* and *Anagyrus kamali.*	The natural enemies have kept the bug population below economic threshold level. Active rearing of natural enemies ceased in 2010.
Veronicella sloanei (Sloan Slug)	2001	After having intercepted the pest in three locations, it is now present in most agricultural areas. It is a minor pest of dasheen, eddoe and citrus.	Field sanitation, trapping, application of mulluscicide	Periodic upsurge in pest population occurs. Resulting in severe defoliation of host crops.
*Anastrapha obliqu*a (West Indian fruit fly)	2002	Pest has affected guava and plum.	Bait spray application, insecticide drenching, removal of host fruits, internal quarantine, public awareness, and bait stations.	There is continuous monitoring and surveillance. There is very low pest prevalence.
Alearocanthus woglomi (Citrus Black Fly)	2003	It has affected citrus causing heavy sooty mould infestation.	Application of fungicide/ insecticide sprays.	The pest is fairly well controlled. Little economic loss has been sustained.
Ralstonia solanacearum (Moko)	2007	Affects *Musa* spp. Several acres of banana/plantain have been eradicated. Most areas have been replanted with other crops.	Sanitation, eradication of infected plants. Certified disease-free planting material.	The pest continues to spread, and has affected most banana-producing locations throughout the country. Protocol for management in place.
Mycospharelae fijiensis(Black Sigatoka)	2009	Affects *Musa* spp. Poor fruit quality has severely affected extra regional trade. Several acres were cut back	Field sanitation, plant nutrition, fungicide application, and other cultural	Disease intensity remains high and host crops are severely affected. Pest management protocol in place but

Pest/Disease	Year of Introduction	Crop Plant Affected & Impact	Management Strategy	Current Status
		due to high infestation.	practices.	not as effective as expected.
Roenila indica (Red Palm mite)	2008	Has severely affected coconut trees. It is also a minor pest of banana and plantain.	No management strategy has been implemented.	Exploration for natural enemies is ongoing. The pest is present country wide.
Cycad Scale	2013	Severe infestation on palms.	Application of insecticide.	Conducting surveillance.
Citrus Greening	2013	Has severely affected citrus countrywide resulting in rapid decline, heavy fruit fall and death of trees. Suspended production and sale of seedlings of citrus plants.	Exploration for natural enemies, plant nutrition, field sanitation and insecticide application.	Citrus continues to be seriously affected. Preparations are being made for the production of certified planting material.

Source: Plant Protection & Quarantine Unit (2013)

Plant invasions are also known on the islands. These include the parasitic love vine or dodder (*Cuscuta* spp.) (Figure 17), leucaena (*Leucaena leucocephala),* wedelia *(Sphagneticola trilobata)* and rubber vine (*Cryptostegia grandiflora)*. The latter is a particular concern in the Grenadines, as it is toxic to livestock and often difficult to control.

Figure 17. Cuscata spp.: Parasitic Plant that Affects Coastal Areas throughout St. Vincent and the Grenadines

The adverse effects of these phenomena must not be seen only in light of their economic cost in terms of the foreign exchange loss but, more

significantly, the social effects on the nation's food and nutrition security and the loss of agricultural biodiversity.

Invasive species are posing an increasing threat to marine biodiversity; specifically, the November 2011 outbreak of and subsequent invasion of lionfish (*Pterois volitans* and *Pterois miles)*. St. Vincent and the Grenadines has undergone a rapid invasion of both seagrass (*Halophila stipulacea)* (Willette *et al*. 2013) and the brittle star (*Ophiothela mirabilis)* (Figure 18) in the coastal marine waters in recent years.

Figure 18. Invasive Halophila stipulaces Seagrass and the Ophiothela Miribalis Brittle Star. Courtesy K. Baldwin

The effects of invasive species cannot be overstated. Their impacts could potentially devastate native populations and endemics. The IUCN Species Survival Commission's Invasive Species Specialist Group developed a list of 100 most invasive species of the world. At least 15 of these species are found in St. Vincent and the Grenadines. Appendix 2 provides further information on these species and the effect they could have on local biodiversity.

2.2.4 Living and Genetically Modified Organisms

Genetically modified crops are becoming an increasingly common feature of agricultural landscapes (Garcia and Altieri, 2014). There are several arguments for and against living and genetically modified organisms. Potential benefits include reduction of pesticide use; easier management of pests, weeds, and natural enemies; and simplification of farming practices and increased efficiency (ibid.). For the purpose of this section, however, we shall examine the potential threats that these modified organisms may have on natural biodiversity.

Genetically modified crop species will interact with the other component species of the agro-ecosystem and surrounding environments, potentially affecting their fitness, population dynamics, ecological roles, and interactions, promoting local extinctions, population explosions, and changes in community structure and function inside and outside agroecosystems. There has been no extensive study to determine the status of modified organisms on the local market but preliminary investigation reveals that modified organisms are likely present in imported items such as corn flakes, margarines and animal fodder (Culzac-Wilson, pers. comm. with supermarket

managers and animal fodder suppliers). Table 17 shows possible genetically modified food imports into St, Vincent and the Grenadines.

Table 17. Possible GM Food Products Imported into SVG 2001 - 2011

Product	Volume (Kg)	Value (XCD)
Soy-product	21 069 214	49 310 296
Corn	31 929 705	21 377 301
Tomato	26	322
TOTAL	**52 998 945**	**70 687 910**

Source: Lynch (2013) with data from the Central Statistical Unit, St. Vincent and the Grenadines

2.2.5 Unsustainable Agricultural Practices

Though there has been a decline in banana production over the last decade, St. Vincent and the Grenadines is still highly dependent on agriculture as an income source. The agricultural practices of peasant farmers often destroy natural biodiversity. Slash-and-burn or shifting cultivation provides a basis for subsistence agriculture and brings about the burning of forests and bush, causing the depletion of nutrients and organic matter in the soil. This is unfavourable to the conservation of forests. It also creates an over-demand for land, resulting in more forest being cleared for planting crops and pasture. The conversion of natural habitats to cropland and other uses typically entails the replacement of systems rich in biodiversity with monocultures, or with systems poor in biodiversity (FAO,1998 *in* Grid Arendal, 2014). The use of agricultural pesticides also has deleterious effects on biodiversity and on groundwater.

2.2.6 Unregulated Land Use

For several decades, there have been efforts to establish and enact a National Physical Development Plan (PDP) that will guide land allocation and use in the country. Production of the PDP is now included as one of the goals of the country's National Economic and Social Development Plan 2013 – 2025.

The absence of a Physical Development Plan has facilitated uncontrolled development leading to environmental degradation. This includes the development of squatter settlements without basic physical and social infrastructure, and an environment where agricultural lands are increasingly being sold for housing and other physical development. In the absence of

the Plan, there is no national policy that (1) directs growth and development, (2) facilitates more comprehensive planning, (3) clearly demarcates land for major uses (protected areas, human settlements, commercial and recreational development etc.) and, to some extent, (4) ensures protection of environmentally sensitive areas.

A comparison of the figures of the land under agriculture in the 1986 and the 2000 agricultural censuses revealed that there was a reduction of 40% in the lands reported under agriculture. Toppin (2010) showed that much of that loss was in the southern part of St. Vincent and in the Grenadines to which there was a decided population shift as revealed by the Population and Housing Census 2001 Report. A loss of land to agriculture is a loss of biodiversity; maybe not so much in terms of genetic loss but more in terms of total production capacity. Furthermore, given that the country is already small and rugged with very limited flat lands, sustaining the national capacity to meet the Millennium Development Goals of reducing poverty and hunger is severely compromised.

2.2.7 Insufficient Policy, Legislation and Enforcement

Biodiversity conservation is a process by which individuals and organizations protect and preserve species through conservation policy, which entails preservation of habitat and management of wildlife species (Douglas, 1978). St. Vincent and the Grenadines has no National Forest Policy or National Environmental Policy or legislative framework under which biodiversity can be conserved and protected; however, a series of measures to prevent biodiversity loss have been identified. One of these is the establishment and implementation of legislative instruments.

Currently, there are four main pieces of legislation that afford protection to the country's terrestrial biodiversity. These are the Wildlife Protection Act of 1987, the Forest Resource Conservation Act of 1992, the Mustique Conservation Act of 1989 and the National Parks Act of 2010. The Wildlife Protection Act and Forest Resource Conservation Act make provisions for the conservation and management of fauna and flora found on the islands. Enforcement of these Acts, however, is limited by the absence of supporting Regulations. Thus, though there are laws in place to protect species and their habitats, the Forestry Department has no legal teeth with which to enforce them.

There are no agreements or Memoranda of Understanding that relate to Multilateral Environmental Agreements on Biodiversity. Since the production

of the Fourth National Report to the UNCBD in 2010, there have been no legislative changes in the environmental field apart from the enactment of the National Parks (Amendment) Act. Furthermore, no effective action has been taken to finalize and enact existing draft legislation such as the draft Environmental Management Act and Environmental Impact Assessment Legislation. One obstacle in this process is the shortage of legal draftsmen but the more important problem is that, while various draft legislation has been prepared at the request of the respective ministries, the Cabinet has not been requested to approve the draft legislation and formal requests have not been made to the Attorney General to finalize the drafts.

2.2.8 Tourism and other Development

The UNCBD and United Nations World Tourism Organization have alluded to the close relationship between tourism and biodiversity, suggesting that they can provide support for each other. While theoretically this may be possible, historically there are many recorded cases of the detrimental effects of tourism on biodiversity, including the displacement of dependent communities. An example of such is the failed marina project at the Ashton Lagoon in Union Island. Prior to the commencement of developmental work at Ashton, "*the lagoon harboured a variety of important flora and fauna including lobster, conch and several* rare *or endangered marine organisms…. The Ashton Lagoon complex, together with a nearby offshore island (Frigate) also provided important habitats for wintering and migrating populations of seabirds, waterbirds, shorebirds and landbirds*" (Price and Price, 1994b).

Following the abandonment of the project in 1995, ecological surveys of the lagoon conducted in 1997 and 2003 showed that "the causeway's blockage of water circulation of the bay caused the western half of the bay to become stagnant and the water turbid. The seagrass beds, lobster, conch and fishes … largely disappeared, and any corals remaining inside the lagoon … mostly dead and overgrown with weedy algae" (Price and Price, 1998; Goreau and Sammons, 2003) among other effects.

In St. Vincent and the Grenadines, there has been some effort by the Ministry of Tourism, particularly through its National Parks and Protected Areas Systems Plan, and other stakeholder agencies to reduce these negative effects. However, efforts have been challenging, and often futile. For example, in the Grenadines, development associated with the construction of hotels, airports and marinas has led to the degradation of several important habitats.

Another example is on Canouan, a small island in the Southern Grenadines just 6 km long and 2 km wide with a population of less than 1,000 residents who are largely involved in fishing, tourism and farming. Islanders traditionally use the beaches for fishing, relaxation and exercise. At the end of the 1990s, large tracts of government-owned lands were acquired on a long-term lease by foreign developers, for the construction of a multi-million dollar hotel complex, casino and golf course. The northern two thirds (486 hectares) of the island, where many of the best beaches are located, have been leased for the hotel complex (Cambers *et al.*, und.). The island also supports an eighteen-hole golf course, a casino, a 200-room resort, and a soon-to-be-extended 1,900m jetport runway (Sustainable Grenadines Inc., pers. Comm.). These activities led to the decimation of much of the island's natural vegetation, including dry woodland and mangroves, and associated fauna, and displacement of local livelihood activities.

2.2.9 Intensive Grazing

Livestock grazing (Figure 19) can be detrimental to biodiversity. Selective grazing, in particular, may encourage the removal of important plant species and allow the predominance of undesirable and invasive species. It also reduces plant diversity within the area. Grazing in forests can expose the ground to sunlight and reduce well-needed soil moisture and insulation, thereby increasing the ground temperature (Primack, 2000).

Figure 19. Livestock Grazing Freely on Deterioriated Lands on Union Island
Photo courtesy Martin Barriteau

2.2.10 Unregulated and Illegal Harvesting

The Wildlife Protection Act (1987) and Forest Resource Conservation Act (1992) guide the harvesting of terrestrial plants and animals, particularly those that are protected. Under the Wildlife Act, a number of listed species including the manicou, agouti and armadillo are protected, except during the months of October through January.

A 2012-2013 study by EPIC confirmed significant poaching on at least a dozen Grenadine islands. Evidence of the impacts included reduced ground

vegetation on Petit Canouan due to burning. Less vegetation increases access to birds' eggs and nestlings. Shooting was reported to occur on the island between rival fishermen seeking to harvest eggs and birds. On Battowia, traps with dead birds were observed. That island is reportedly targeted for harvesting red-footed booby chicks and adults. Dozens of booby carcasses were found at Baliceaux. And eggs are reportedly taken from the Tobago Cays Marine Park (K. Lowrie pers. comm. with fiisherman).

Some of these remote islands are classified as globally or regionally Important Bird Areas (IBA) under Birdlife International criteria. This means that they represent less than 1% of the global or regional breeding population for a species. These remaining breeding colonies are crucial to declining seabird populations, ensuring their continued viability in the Antilles and beyond. It is also essential to note that harvesting has likely suppressed or extirpated populations at many other sites which historically may have met IBA criteria. With appropriate management of threats, including harvesting and invasive species, restoration of seabird population levels is feasible (Lowrie, 2012).

On St. Vincent, illegal harvesting of the St. Vincent Parrot is also known to limit its population (Culzac-Wilson, 2005; Gochfeld, 1974; Andrle and Andrle, 1973; Butler 1988). The Forestry Department (1994) in a paper on the conservation of the parrot stated: "...the illegal trade still occurs, although it is difficult to determine to what extent." There appeared to be a "significant amount of smuggling of St. Vincent Parrots for the illegal pet trade." (Forestry Department, 2001).

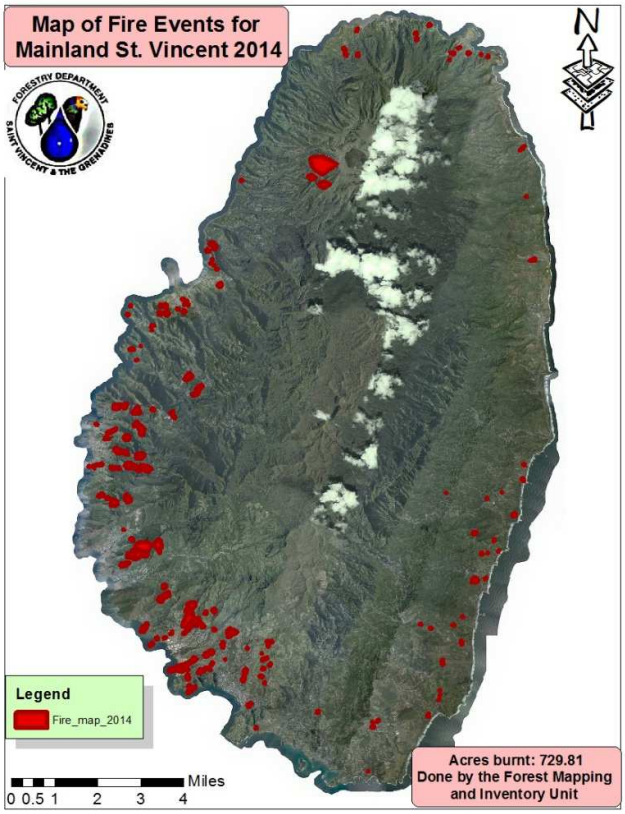


Figure 20. Incidence of Bushfires on St. Vincent - January to July 2014.
Source: the Forestry Department, 2015.

2.2.11 Bushfires

Bushfires in St. Vincent and the Grenadines are believed to be primarily caused by anthropogenic factors. The incidence of bushfire is

increasing and the extent of damage on an annual basis is a growing cause for concern. In 2013, the Forestry Department recorded some 121 fires on St. Vincent. These fires occurred between Kingstown and Chateaubelair. However, between January and July 2014, the Department had already recorded some 181 fires islandwide (refer to Figure 20), covering some 729.81 acres (Culzac-Wilson pers. Comm. with the Forestry Department).

Figure 21. Vegetation Loss Due to Bushfires
Photo courtesy Forestry Department

Recurrent forest fires occur primarily on grassy areas, scrub woodland and marginal lands. Following these fires, soil erosion on slopes is exacerbated and rocks and boulders become loose (Figure 21), posing a hreat to houses particularly after heavy rains.

Frequent, uncontrolled ground fires may not kill mature trees within an area but may impoverish groundcovering floral and faunal communities (Primack, 2002). Fires are used to clear farmlands, for burning agricultural, garden and other debris and during hunting. These fires may often spread unintentionally to other areas.

2.2.12 Pollution

Environmental degradation often results from pollution, commonly caused by pesticides, sewage, fertilizers from agricultural fields, industrial chemicals and wastes, emissions from factories and automobiles, and sediment deposits from eroded hillsides (Primack, 2002). Although environmental pollution is sometimes highly visible and dramatic, as in the case of massive oils spills, it is the subtle, unseen forms of pollution that are probably the most threatening – primarily because they are so insidious.

There are several sources of pollution on St. Vincent and the Grenadines, including factory and vehicular emissions, poor garbage disposal and inappropriate use of agricultural fertilizers and pesticides. Those having greatest effects on the island's terrestrial biodiversity, however, are related to agricultural activity and solid waste disposal.

The Solid Waste Management Unit (SWMU) of the Central Water and Sewerage Authority (CWSA) is responsible for refuse collection throughout the State. The SWMU and its sub-contractors execute a consistent refuse collection service that is offered twice per week to residents in the Grenadines and once weekly in every village on mainland St. Vincent (CWSA, 2013). The SWMA also offers a free island-wide white goods collection service.

Figure 22. Plastics and Other Litter on Union Island Wetland. *Photo by Amiro Perez*

Despite the regular collection system, however, illegal dumping in St. Vincent and the Grenadines has gotten worse over the years (G. Saunders pers. comm. with Lystra Culzac-Wilson). Empty plastic and styrofoam packages often end up on beaches (Figure 22) and in rivers and seas, and can trap wildlife and/or cause them to choke and starve.

Marine pollution in St. Vincent and the Grenadines primarly results from illegal land-based dumping and littering, increased nutrients from greywater, fertilisers, erosion and sedimentation. Runoff from watersheds was the major source of pollution identified in the Grenadine Islands (Willams, 2008). Likewise, marine pollution such as wastewater from boats can have a negative environmental impact.

Declining coastal and marine water quality can potentially effect human health and cause severe ecological damage to the marine ecosystem. Charter yachts as well as some ships and ferries, were the only marine resource user groups identified to contain sewage (i.e. black water) holding tanks onboard their vessels. Despite this, less than 40% of these vessels use holding tanks as a result of the lack of wastewater pump-out or treatment facilities at any of the charter yacht facilities in the country (Baldwin *et al.*, 2007). Marine pollution from both solid waste and sewage disposal from land-based and boat sources (ECLAC, 2004; Williams 2008) continues to threaten marine life and human health.

2.2.13 Poverty

Poverty has many dimensions including low and high variable levels of income and consumption, physical insecurity, poor health, low levels of education, disempowerment, a heavy burden of work or unemployment, and isolation (both social and geographical). Poverty is a major cause and consequence of environmental degradation and resource depletion. The very poor have limited scope to plan ahead and make natural resource investment like soil conservation that give positive returns for long periods of time.

In St. Vincent and the Grenadines, high unemployment rates, reduced agricultural activity among the younger generation, and poor agricultural yields due to degraded soils have driven households to obtain alternative sources of livelihood. In rural areas where the majority of poor live, there are few income generating opportunities and many have resorted to charcoal production and illegal marijuana cultivation. Yet others resort to poaching for sale and for domestic food provisions. These factors also contribute to persons farming and squatting on marginal lands (Figure 23), which further degrades the land, reduces its diversity and poses a threat to the persons living in these areas.

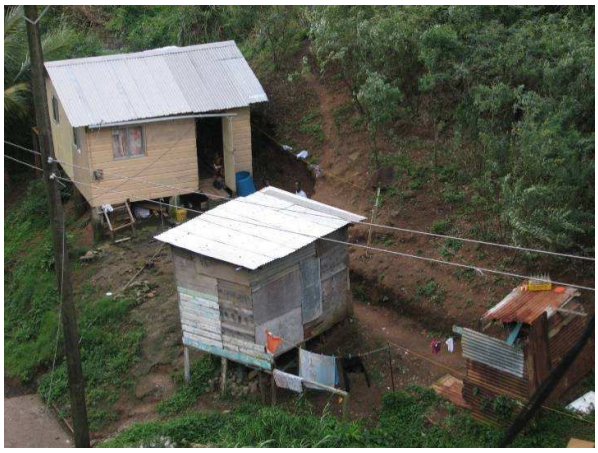


Figure 23. Squatting in Chrisville, Gibson Corner. *Photo courtesy Lisa Sorenson*

In 1996, a poverty assessment conducted in St. Vincent and the Grenadines reported that 37.5% of the population (43,875 persons) were poor (Kairi Consultants Ltd., 1996). In 2001 the country was identified as having the highest levels of poverty in the OECS, at 37.5%, and the worst level of income inequality in the region (Thomas, 2001).[5] Studies conducted under the Country Poverty Assessment in 2008 revealed that between 2007 and 2008 the Poverty Headcount Index was at 30.2% - a reduction in poverty level of 7.3% over the 1995/96 figure. A more favourable reduction was seen in the indigence level of 2.9% - a reduction of 22.8%. This trend is summarised in the

[5] The *Gini coefficient* of income inequality was reported by Thomas (2001) to be 0.56, the worst in the Region.

National Report on the Millenium Development Goals 2012 which states that over the twelve-year period 1995/96 - 2007/08, poverty decreased from 37.5% to 30.2% and indigence from 25.7% to 2.9%. The poverty gap ratio also decreased, from 12.6 points to 7.5 points and poverty severity index from 6.9 to 3.0 (Government of St. Vincent and the Grenadines, 2012).

The National Economic and Social Development Plan 2013-2025 states that considerable progress has been made with respect to the reduction of abject poverty; however, the vulnerability levels remain a great cause for concern. According to the 2007/2008 St. Vincent and the Grenadines Poverty Report, poverty in general remains high and its reduction is critical.

2.2.14 Limited Environmental Awareness

Agenda 21, drawn up at the Rio Earth Summit in 1992, states that education, including formal education, public awareness and training, should be recognized as a process by which human beings and societies can reach their fullest potential. Education is critical for promoting sustainable development and improving the capacity of the people to address environmental and development issues. Formal and non-formal education is indispensable in changing people's attitudes (United Nations Educational, Scientific, and Cultural Organization, 1992). The importance of education to biodiversity conservation can therefore not be over-emphasized.

In St. Vincent and the Grenadines, there is growing appreciation among natural resource managers of the importance of environmental education in changing negative attitudes and behaviour towards the islands' biodiversity. In fact, it is such that each governmental and stakeholder agency has its own education outreach component, though in some cases this may be limited by capacity and resource availability, including financial resources. There is an ongoing impetus by the Curriculum Development Unit within the Ministry of Education to integrate environmental issues into the national schools' science curriculum (A. Muhammed pers. comm. with Lystra Culzac-Wilson).

Notwithstanding these efforts, there is still a lack of community awareness and education in relation to the social, economic and ecological significance of biodiversity, and a need for ongoing and increased environmental awareness interventions.

2.2.15 Limited Research

Biodiversity research and the sharing of associated data are essential components of biodiversity conservation. These include surveys, inventories, and other research on ecological and biological resources. It also involves the inclusion of traditional knowledge. Conservation assessments are used to determine a threat rating for species; that is, to find out if they are under threat due to factors such as habitat destruction, over-harvesting or climate change. The results of these assessments are then used to inform conservation actions.

The unavailability of data has been continuously lamented by stakeholder agencies. This is often a result of a combination of factors including the absence of a national culture of research, limited expertise, and poor documentation. Without these data, natural resource managers such as the Forestry Department are unable to make many informed decisions on the management of biodiversity.

CHAPTER THREE

Assessing the Implementation of the NBSAP and Progress in Mainstreaming Biodiversity

Marcgravia umbellate: **Photo by L. Culzac-Wilson**

3.0 INTRODUCTION

This chapter assesses the status of implementation of the National Biodiversity Strategy and Action Plan (NBSAP) 2000 and the progress made in mainstreaming biodiversity since publication of the 4th National Report in 2010. The Chapter is divided into two parts. The first part presents an overview of the NBSAP and the priority actions identified to be undertaken to manage and conserve biodiversity, followed by an assessment of the progress made in implementing these actions. The second part examines the progress made in mainstreaming biodiversity, using the strategies outlined in the 4th National Report to the UNCBD as the starting point. In each case the successes acheived, obstacles encountered and lessons learned are presented, serving as the basis for revision of the strategy and action plan for the next period.

3.1 Overview of the NBSAP 2000

The National Biodiversity Strategy and Action Plan 2000 for St. Vincent and the Grenadines was guided by ten (10) key principles which are considered essential to successfully conserving national biodiversity. The principles are presented in Box 2.

Box 2. Principles for Biodiversity Conservation in St. Vincent and the Grenadines NBSAP 2000

1. Every form of life is unique, and warrants respect from humanity.
2. All Vincentians depend on local biodiversity and therefore have a responsibility to contribute to the conservation and sustainable use of biological resources.
3. Policy, and institutional strengthening is required in order to create conditions under which national biodiversity conservation can become an integral part of the decision making process, through effective implementation.
4. All Vincentians should be educated about local biodiversity and be given an opportunity to participate in decision-making that affects biodiversity.
5. Biodiversity is best conserved in the wild (in situ).
6. An ecological approach to resource management is central to achieving biodiversity conservation and the sustainable use of biological resources.
7. Management of biodiversity must be ecologically and economically sustainable.
8. Conservation of biodiversity should proceed on the basis of the best knowledge available, using approaches that can be refined as new information is gained.
9. Biodiversity conservation requires the cooperation of government and nongovernment organizations, resource users and the community in general.
10. Regional and international cooperative action and sharing of knowledge, cost, and benefits are essential to biodiversity conservation.

The Strategy then identified five issues that affect biodiversity loss in the country and, based on those issues, articulated a set of actions to be taken to stem iodiversity loss over the next five (5) years. The issues identified were:

- Habitat Loss and Fragmentation
- Over-exploitation of Plant and Animal Species
- Introduction of Species and Emigrant Species
- Pollution of Soil, Water and Atmosphere
- Intensive Mono-culture Agricultural System

To address the five priority issues, the NBSAP set out the following key approaches to implementation. Specific actions that were recommended based on these approaches are summarised in Table 17.

I. Revision, updating and harmonization of environmental legislation
II. Institutional strengthening for St. Vincent and the Grenadines
III. Resource (biodiversity) inventory (terrestrial and marine)
IV. Development of GIS database
V. Educational Awareness
VI. Human resource development
VII. Incentives and disincentives
VIII. Mechanism for monitoring the implementatikon of biodiversity conservation

In addition, a total of seven (7) specific projects were identified to aid in implementing specific actions in the NBSAP.

3.2 Assessment and Further Recommendations in the 4th National Report to the CBD – 2010

The overall assessment of the status of implementation of the NBSAP for the period 2000 to 2010 was that it was less than satisfactory, that it was not used to inform planning in key sectors, and that most of the specific activities included in the various priority areas were not done (4th National Report to the UNCBD). Table 17 below summarises the priority actions and activities contained in the NBSAP and those that were implemented. The Table also summarises the additional actions recommended in the 4th National Report (2010) and the achievements over the period 2010 – 2015.

Table 18. Progress Made in Implementing the NBSAP from 2000 to 2015

NBSAP (2000) and 4th National Report (2010) Proposals		Action Taken 2000-2010 (As in the 4th National Report to the UNCBD)	Actions Recommended in the 4th National Report	Actions taken 2010-2015
Priority Action	**Specific Activities Recommended**			
Revision and Updating of Environmental Legislation	• Amend Wildlife Protection Act to expand category of protected species • Update Marine Parks Act • Enact national park legislation to protect distinctive flora and fauna • Document criteria for designat-ing marine conservation areas • Develop regulations for the Forest Resource Conservation Act (1992) and the Wildlife Protection Act • Appoint a Chief Wildlife Officer and an Advisory Committee, and establish a Conservation Fund • Establish a Conservation Committee as required by the Forest Resource Conservation Act (1992)	Revision and updating of all the relevant legislative instruments were undertaken under the OECS Protecting the Eastern Caribbean Region's Biodiversity (PERB) project. The specific legislation addressed were: • The Wildlife Protection Act • The Marine Park Act • The National Parks Act • The Environmental Management Act The legislation is expected to be passed by the second quarter of 2010. When this is completed, all the activities outlined under this priority action would have been completed. Additionally, documentation of criteria for designating marine conservation areas was achieved through the ecological GAP analysis for the Protected Area System exercise which was conducted in 2006. • Though not noted in the 4th National Report, a draft Environmental and Biodiversity Coordination Act was developed in 2006 as part of an OECS effort to harmonize comprehensive		• Regulations to the Forest Resource Conservation Act (1992) were drafted in 2011. It is still in draft due to the need to resolve relationship with the draft legislation for CITES • An Environmental Health and Management Act was drafted in 2013. It seeks to combine environmental health and environmental management in one Act, consistent with the current institutional framework. This is expected to be enacted in 2015. • The National Parks (Amend-ment) Act, 2010 made amend-ments to the National Parks Act, 2002 including expanding the definition of National Parks to include protected areas and introducing a definition of "biological diversity." • Environmental Impact Assess-ment Regulations (May 2015) under the Town and country Planning Act (1992) have been drafted. Biodiversity aspects have been included among likely significant effects to be assessed.

NBSAP (2000) and 4th National Report (2010) Proposals		Action Taken 2000-2010 (As in the 4th National Report to the UNCBD)	Actions Recommended in the 4th National Report	Actions taken 2010-2015
Priority Action	**Specific Activities Recommended**			
		biodiversity legislation across the territories		
1. Institutional Strengthening for St. Vincent and the Grenadines	• Review existing institutional structure and define specific biodiversity conservation mandates for relevant institutions • Establish policies, guidelines and programmes for biodiversity conservation • Devise regulatory and administrative framework for environmental management to ensure enforcement and compliance • Make specific recommendations for institutional strengthening of the Environmental Unit and other relevant agencies • Increase fisheries staff for Bequia and Canouan • Improve communications among resources management agencies	• Reviews of existing institutional structure conducted and factors limiting effective implement-ation were identified in the 2005 National Capacity Self-Assessment (NCSA) project. • The draft Environmental Management Act (EMA) 2009 outlines a set of mechanisms for institutional strengthening (Section. 2.2.2.1). • The National Parks, Rivers and Beaches Authority (NPA) was operationalised in 2005, under the Ministry of Tourism, with responsibility for protected areas (Section 2.2.2.2). • Funding and human resource capacity constraints are still major barriers.	• Develop and implement a strategy for communicating the importance and relevance of the NBSAP across sectors and agencies; • Establish linkages between the NBSAP and the national millennium development goals (MDGs). • The communications strategy should enhance engagement of civil society groups and the general public. • Improve access to assistance from international donors for achieving concrete actions on the ground.	• No institutional strengthening has occurred. However, the new draft Environmental Health and Management Act (2013) proposes a revised institutional structure including establishment of a Department of Health and Environment and an Environmental Health and Environmental Commission. • Line agencies continue to face institutional capacity challenges (see Human Resource Development below). • See Educational Awareness below for communications • The NBSAP was not revised to incorporate the MDGs. The period of the MDGs has now ended; however, the NBSAP 2015 will incorporate Poverty Reduction.
2. Resource (Biodiversity) Inventory	• Undertake inventory of the quantities, locations, habitats etc. of marine and terrestrial biodiversity	No systematic efforts have been made to expand or enhance biodiversity research and inventory. Most activities set out	The establishment of a national programme of on-going monitoring to document the status	• A research-based conservation plan is in place for the St. Vincent Parrot. Apart from this, all agencies report that they do not have the resources to carry out a

NBSAP (2000) and 4th National Report (2010) Proposals		Action Taken 2000-2010 (As in the 4th National Report to the UNCBD)	Actions Recommended in the 4th National Report	Actions taken 2010-2015
Priority Action	**Specific Activities Recommended**			
(Terrestrial and Marine)	• Determine carrying capacity of terrestrial conservation areas and marine parks • Study the effects of migratory egrets on indigenous ecosystems • Examine the impacts of nematicides, insecticides, fungicides and fertilisers, and the effects of banana cultivation on the biodiversity • Research the potential uses of unutilized and under-utilized species • Establish a national herbaria facility • Establish hunting and fishing seasons for protected species, and limits to quantities that can be harvested. • Complete demarcations of the forest boundary and establish buffer zones.	in the NBSAP are undone. A few small-scale projects have been undertaken that have contributed in some way to improving knowledge on various aspects of SVG's biodiversity as outlined in sect 2.2.4 of the 4th National Report	and patterns of change in terrestrial flora and fauna species and their habitats is still an outstanding priority area for action.	national inventory of biological resources. The last inventory of forest species was undertaken in 1993 when some pre-2010 work on special groups (e.g. terrestrial invertebrates by de Silva and Wilson, 2006) was done. • No carrying capacity studies or studies of specific species other than the St. Vincent Parrot have been conducted. • With the decline in banana cultivation, a study of the impacts of the cultivation of this crop on biodiversity is no longer deemed necessary • There is no information available on any plans to establish national herbaria • Closed season are in place the harvesting of lobster, conch, iguana and turtles. • The GIS at the Forestry Department has mapped forests by type and categories. • Extensive seabird breeding colonies surveys were conducted in St. Vincent and the Grenadines by EPIC during 2009–2010. • Monitoring is addressed in item 7 below
3. Development of GIS Database	• Establish a committee to guide GIS Development Policy • Establish GIS goals and objectives • Establish a national biodiversity database including formats and standards for accuracy and detail	A national GIS Unit was set up in 2008 within the Physical Planning Department. There is also some capacity (though limited) within the Forestry and Fisheries Divisions as well as the NPA.		• There is no biodiversity-specific GIS database. The central National GIS for which the Physical Planning Department is the repository, is still being developed. All Government agencies, including the Environmental Department and all

NBSAP (2000) and 4th National Report (2010) Proposals		Action Taken 2000-2010 (As in the 4th National Report to the UNCBD)	Actions Recommended in the 4th National Report	Actions taken 2010-2015
Priority Action	**Specific Activities Recommended**			
	• Facilitate data transfer between institutions responsible for biodiversity and natural resource management	However, the focus of biodiversity-related GIS work has been on determining land-use and acreage rather than the geographic distribution of species. The Unit still faces shortages in equipment and licenses. (Section 2.2.5)		biodiversity data, will feed data into this system and will have access to it as well. • Protocols are being developed for inter-agency data sharing. During 2006-2012 the GIS-based Grenadines Marine Resource and Space-use Information System (MarSIS) was developed by the Centre for Resource Management and Environmental Studies (CERMES), of the University of the West Indies (UWI) in association with Sustainable Grenadines Inc. (SusGren). This provides substantial data on the marine and coastal ecosystems of the Grenadine islands
4. Educational Awareness	• Undertake educational media productions • Train government agencies, department staff, local private organisations and grassroots groups • Educate regulatory and law enforcement agencies • Improve extension services by providing room for educational activities and library with appropriate information • Establish co-management arrangements with businesses and NGOs operating in marine and terrestrial conservation areas	No comprehensive education and public awareness strategy exists. Implementation has been largely ad-hoc. The Forestry Dept. has been involved in television productions and conducts training for police officers in enforcement of wild-life protection laws. Public education is an integral component of the Fisheries Dept.'s sea turtle conservation programme. (Section 2.2.6)		• Each of the following departments have ongoing public education and awareness programmes, which mainly focus on various aspects of biodiversity conservation: Department of Forestry, Fisheries Division, National Parks Authority, Ministry of Agriculture, Department of Environment • What is needed is a central education and awareness programme for biodiversity that draws on the work of all relevant agencies • Such a programme would need a pre- and post Knowledge, Attitude and Perception(KAP) survey to assess its impact on the level of awareness of biodiversity matters with the population

NBSAP (2000) and 4th National Report (2010) Proposals		Action Taken 2000-2010 (As in the 4th National Report to the UNCBD)	Actions Recommended in the 4th National Report	Actions taken 2010-2015
Priority Action	**Specific Activities Recommended**			
				of St. Vincent and the Grenadines
5. Human Resource Development	• Strengthen capacity of the Forestry Department through training in ecology research, wildlife management and resource economics • Undertake GIS user training for relevant government and non-governmental agencies	Staff at the Forestry Dept. has been trained in ecological wildlife management. (Section 2.2.7)		In recent years the Forestry Department has experienced loss of human resources as senior personnel have retired and others have left the department for other reasons. Currently there are several vacant posts of Forestry Officer-I and Forestry Officer-III that need to be filled. There is also need for additional staff within the Enforcement Unit, as well as additional staff and training within the Watershed Management Unit.
6. Incentives and Disincentives	• Enhance regulatory control of development activity on private and public lands • Research potential uses of unutilized and under-utilized terrestrial and marine species • Reduce pressures of urban expansion by encouraging higher density housing, in-filling of residential and commercial areas, and enforcing zoning control • Provide incentives to increase productivity of lands under cultivation • Provide incentives to reduce the use of toxic chemical pesticides, herbicides, and fertilisers.	Land-use planning/ zoning and the application of EIAs are being utilized by the Ministry of Planning to reduce development pressures in sensitive areas. However, prosecution of offenders is a challenge The Fisheries Division is undertaking research to expand uptake of under-utilized species. High-density housing is not considered culturally appropriate. Since the decline of the banana industry, cultivation of this crop is no longer considered a threat. Alternative livelihood programmes for marijuana farmers have had little success.	No additional recommendations in the 4th National Report.	No additional recommendations in the 4th National Report.

NBSAP (2000) and 4th National Report (2010) Proposals		Action Taken 2000-2010 (As in the 4th National Report to the UNCBD)	Actions Recommended in the 4th National Report	Actions taken 2010-2015
Priority Action	**Specific Activities Recommended**			
		No work has been done on removing perverse incentives. (Section 2.2. 8)		
7. Monitoring the Implementation of Biodiversity Conservation	The Ministry of Health & Environment as lead agency for biodiversity and protected area management, should establish specialized sub-committees to administer and monitor implementation of biodiversity management and conservation, giving consideration to: • Policy formulation • international agreements and protocols • legislation and regulations • compliance • assessment, licencing and approvals • guidelines and standards • pollution prevention • monitoring • education and development, and • environmental reporting	Monitoring implementation remains a challenge. But, the EMA 2009 sets out specific require-ments for coordination, monitor-ring and reporting that may improve the situation once the Act is passed. (Section 2.2.9)	**Improve Biodiversity Monitoring and Research** • Make a concerted effort to develop a biodiversity information system that is part of a *Clearing House Mechanism* (CHM). • Establish alliances with Universities, research institutions and environmental NGOs • Establish national targets and develop indicators to guide implementation and assess progress	• No monitoring programmes are currently in place except for the St. Vincent Parrot. • This is recognised by all as a priority area and several programmes are on stream to prepare for such monitoring, particularly in the marine environment. For example: • The Sustainable Finance initiative for Protected Areas: indicators are being developed and a workshop to review is scheduled for 2015 as part of the Eastern Caribbean Marine Management Areas (ECMMA) initiative. • SVG has committed to the CBD's Caribbean Challenge Initiative' (CCI), a pledge by several countries of the region to conserve 20% of terrestrial and coastal marine areas by 2020. An estimated 8.5% (12,131 ha) of the SVG nearshore marine shelf is already under some form of protection.

3.3 Status of Implementation of the NBSAP to 2015

I. Revision and Updating of Environmental Legislation

There is no comprehensive legislation in St. Vincent and the Grenadines to implement the Convention on Biological Diversity. Progress has been made in the form of the National Parks (Amendment) Act, 2010, but no action was taken in respect of the Environmental and Biodiversity Coordination Act that was drafted in 2006. Additional draft legislation has been prepared including Regulations (2011) to the Forestry Resources Conservation Act, a draft Environmental Health and Management Act (2013) and EIA Regulations (2015) under the Town and Country Planning Act, 1992. Until these drafts are ultimately enacted, however, biodiversity conservation will continue to be administered under existing legislation such as listed below:

- Forest Resources Conservation Act
- Wildlife Protection Act
- Botanical Garden Act
- Fisheries Act

II. Institutional strengthening for St. Vincent and the Grenadines

The Ministry of Agriculture, Rural Transformation, Forestry, Fisheries and Industry is the agency responsible for administration and the day-to-day execution of activities related to biodiversity management and conservation, including responsibility for formulating relevant policies, plans, programmes and activities. Within the Ministry of Agriculture, the two critical entities are the Department of Forestry and the Fisheries Division.

The Department of Forestry is responsible for managing and conserving land-based, non-agricultural, wild flora and fauna diversity. This includes mapping and maintaining an inventory of all forests resources, managing wildlife species, research, inventories, enforcing relevant legislation,[6] managing the utilisation of timber and non-timber forest produce, implementing all forestry related work and implementing public education on the management and conservation of forests. The Fisheries Division has responsibility for all activities in the fisheries sector including fisheries management, conservation and development; fisheries

[6] The relevant legislation here includes the Wildlife Protection Act and the Forest Resources Conservation Act.

extension, public education and marketing; quality assurance and product development; and fisheries information and research.

The NBSAP called for an institutional review and related actions for biodiversity management. The 4th National Report notes that such a review was conducted as part of the National Capacity Self-Assessment in 2005 and that funding for institutional strengthening was a major constraint. Since then no institutional strengthening for biodiversity management has been reported. There are plans to restructure the institutional framework by creating a Depart6ment of Health and Environmental Management to formalise the current situation, and this is supported by the draft Environmental Health and Management Act. At the same time, line agencies have reported loss of human resource capacity and funding continues to be a constraint.

III. Resource (Biodiversity Inventory: Terrestrial and Marine

The NBSAP called for an inventory of the quantities, locations and habitats of marine and terrestrial biodiversity, determination of the carrying capacity of conservation areas, establishing hunting and fishing seasons for protected species and demarcation of forestry boundaries. To date no such inventories have been conducted for terrestrial biodiversity due to lack of resources. Similarly, there have been no carrying capacity studies. While inventories of the coastal and marine habitats for mainland St. Vincent is also still lacking, between 2006 and 2012 the Marine Resource and Space-use Information System (MarSIS)[7] was developed, providing extensive data for the Grenadine islands (see Section 1.1.5, pg. 22). Extensive seabird breeding colonies surveys were also conducted in St. Vincent and the Grenadines by EPIC during 2009–2010. In addition, there are closed seasons in place for the harvesting of such species as lobster, conch, iguana and turtles, and progress has been made with respect to the demarcation of forested areas. The latter is addressed further in item III below – GIS.

IV. Development of GIS Database

Database development and management are critical to effectively managing biodiversity. The NBSAP identified a set of activities towards establishing a GIS, including a biodiversity database. In 2008 a central national GIS was

[7] The Grenadines Marine Resource and Space-use Information System (MarSIS) is a project of the Centre for Resource Management and Environmental Studies (CER%MES), University of the West Indies, Barbados, developed in association with the NGO: The Sustainable Grenadine, Inc. (SusGren). See www.grenadinesmarsiss.com.

established within the Physical Planning Department. Since then efforts have been ongoing to develop this system to meet the needs of all agencies requiring such a facility, including the Department of Environment, and protocols for data-sharing are being developed. For this to be of significant benefit to biodiversity management, however, the inventory of biodiversity resources is needed to provide the requisite data with which to populate the GIS.

V. Educational Awareness

The call for enhanced education and public awareness has been multi-pronged, identifying various target groups and strategies. Today the approach is much the same as described in the 4th National Report; that is, a number of different agencies have there discreet educational programmes which, at any point in time, focus on issues of import to that agency. For example, the Fisheries Division summer 2015 educational programme is focussing on the invasive lionfish as well as marine turtles and beach cleaning triggered by the sargassum seaweed problem.

A harmonised biodiversity education programme is still a clear necessity. For the purpose of monitoring and reporting and, given the global Aichi Target and corresponding national target of enhancing biodiversity awareness, it is strongly recommended that such a programme includes pre- and post-implementation Knowledge, Attitudes and Perception (KAP) surveys.

VI. Human Resource Development

Human resource development is an on-going priority for biodiversity conservation and an on-going challenge due to the financial resource constraints confronting the country. While capacity needs specialised in areas of staffing and training were identified for the Forestry Department – the agency which is the focus of this item in the NBSAP – that department now reports continuing human resource capacity challenges as contained in Table 18. Continuous and creative resource mobilisation, though by no means an easy task, is one possible solution to on-going human resource constraints.

VII. Incentives and Disincentives

Specific activities recommended under this item in the NBSAP were addressed in the 4th National Report and no further recommendations were made. Some priorities have shifted over the last fifteen (15) years, for example the cultivation

of bananas has declined to the point where this is no longer considered a threat to biodiversity. Others continue, however - for example the need for development controls on public and private lands. The revised NBSAP (2015) will address continuing and emerging priorities.

VIII. Mechanisms for Monitoring the Implementation of Biodiversity Conservation

No monitoring programmes to maintain a continuous record of the current and changing status of biological resources, other than the Amazona guildingii parrot, have been established. However, this is recognised by all as a priority area and several programmes are on stream to prepare for such monitoring, particularly in the marine environment. For example, under the Sustainable Finance initiative for Protected Areas, indicators that will assist in monitoring are being developed. A workshop to review these indicators is scheduled for 2015 as part of the Eastern Caribbean Marine Management Areas (ECMMA) initiative.

Additionally, St, Vincent and the Grenadines has recently commited to the Convention on Biological Diversity's 'Caribbean Challenge Initiative' (CCI). The CCI is a pledge by several countries of the region to conserve 20% of both terrestrial and coastal marine areas (coastal marine shelf area up to the 200 metre isobath) by 2020 (CCI, 2013). At present, there is one no-take marine park, one marine reserve and five marine conservation areas designated in the country (Lee 2009; MarSIS 2012, Figure 22). Thus an estimated 8.5% (12,131 ha) of the nearshore marine shelf is under some form of protection (Table 19). Figure 25 represents the proportion of the various marine habitats within these designated marine protected areas.

Table 19. St. Vincent and the Grenadines Jurisdictional Marine areas Listed by Marine Feature of Interested Associated Area in Hectares

Feature of interest	Area (ha)
Exclusive Economic Zone	3,163,354
Near shore marine area	143,000
CCI Target 20/20	28,600
Marine Protected Areas	12,131
No-take Marine Parks	9,222

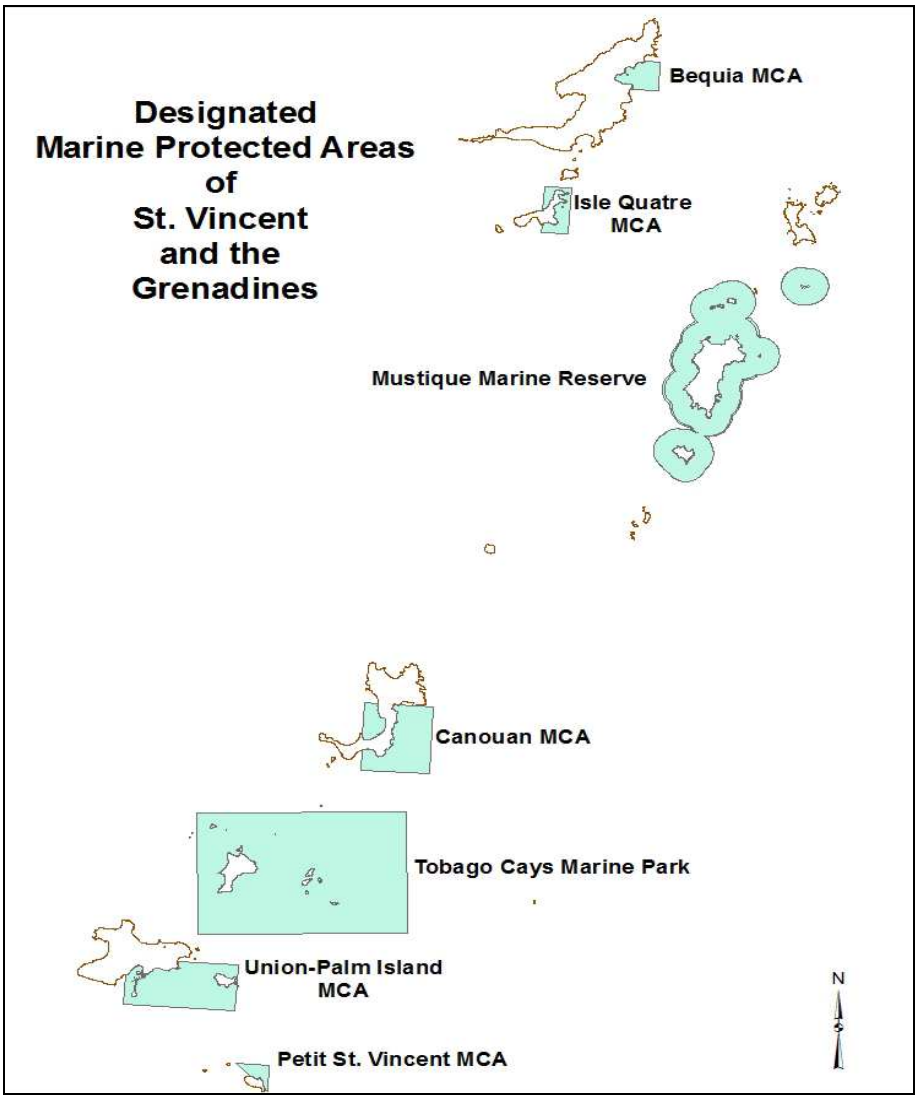


Figure 24. Designated Marine Protected Areas of St. Vincent and the Grenadines

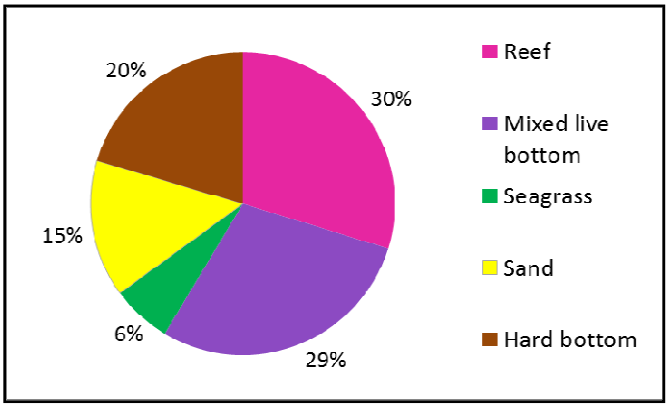


Figure 25. Proportion of Marine Habitats Protected by Marine Protected Areas in SVG

3.2 Status of Mainstreaming Biodiversity Conservation

The underlying causes of biodiversity loss can be addressed by mainstreaming biodiversity across government and society thereby reducing the direct pressures on biodiversity and promoting sustainable use. Biodiversity mainstreaming is the process of embedding biodiversity considerations into policies, strategies and practices of key public and private actors that impact or rely on biodiversity, so that it is conserved and sustainably used both locally and globally (Huntley and Redford, 2014. p.7). The result is that responsibility for, and ownership of, biodiversity conservation is extended beyond the Ministries of Environment, to the extent where it becomes shared by all economic sectors.

The Fourth National Report to the UNCBD assessed the status of mainstreaming to 2010 based on a review of: (a) the existing level of inter-ministerial coordination, (b) implementation of the provisions contained in relevant sectoral plans and policies, and (c) the level of cross-sectoral integration as set out in national level strategies and plans. The extent of coverage of that review as documented in existing policies, plans and strategies is summarised in Table 20 below.

Table 20. Aspects of Mainstreaming Reviewed in the Fourth National Report to the UNCBD

Sectoral Coordination	Integration of biodiversity concerns in sectoral plans & policies	Cross-sectoral integration (Biodiversity mainstreaming)
Inter-Ministerial Coordination	Forestry Sector plans and policies	The National Environmental Management Strategy and Action Plan (NEMS)
The Environmental and Biodiversity Coordination Act	Tourism Sector Plans	The Interim Poverty Reduction Strategy Paper
Multi-sectoral Committees	Fisheries Sector Policy	The (draft) National Economic and Social Development Plan (NESDP)
Co-management Partnerships	Agricultural Sector Policies	The (draft) National Physical Development Plan (NPDP)
Professional Networks: Fostering Multi-scale Integration		

The 4th National Report concluded that although many policies and plans exist that in some way incorporate biodiversity conservation, this has not necessarily resulted in effective mainstreaming. In fact:

> More often than not, many plans and policies are not widely utilized by all the key agencies in their planning and decision making. There is still widespread concern among environmental professionals that the environment is still somewhat of an after-thought and that the consequences for biodiversity are still steeply rising. Furthermore, the lack of sustained funding and resources to support implementation of the plans makes it extremely difficult to coordinate and enforce the requirements for the protection of habitat areas which support important biodiversity components (4th NR, p65).

Based on this assessment a number of actions were recommended. These actions and the progress made in implementing them are summarised in the Table below:

Table 21. Progress Made in Mainstreaming Biodiversity 2010 to 2015

Actions Recommended in the 4th NR	Actions taken 2010-2015	Progress
Sensitize key decision-makers/ policy-makers through: **i.** Communication, eduction and public awareness strategy **ii.** Champion for conservation **iii.** Payment for ecosystem services **iv.** Involving stakeholders at all stage **v.** Inter-agency collaboration **vi.** Data-sharing and accessibility protocols	i. As noted in Table 17 above, most environmental agencies dealing with biodiversity matters have ongoing public education and awareness programmes that address issues falling within their specific areas of responsibility ii. No Champion for conservation has been appointed iii. User fees are currently charged only in the Tobago Cays Marine Park iv. Stakeholders are involved through public education and awareness programmes, on the Boards of Management of agencies, through inter-agency committees and through involvement of national and regional non-governmental organisations v. Inter-agency collaboration occurs through a number of Boards of Management, Cabinet-appointed Committees, consultations mandated in existing legislation, and informal inter-agency consultations among staff. vi. Data-sharing Protocols are being prepared for the national GIS resident in the Physical Planning Department	i. There is no indication that decision-makers or policy-makers are the direct target of education strategies ii. The Department of Environment is giving active consideration to a Champion for conservation v. Under the Forestry Resource Conservation Act the Director of Forestry is mandated to consult with the Department of Agriculture; the Central Planning Unit; the Central Water and Sewerage Authority; St. Vincent Electricity Services; the National Trust; and such other private conservation organizations or government agencies as he thinks fit. o The Physical Planning Board established under the Town and Country Planning Act comprises technical personnel from several agencies including the Ministry of Health and Environment o The draft Environmental Health and Management Act (2013) calls for an Environmental Health and Environmental Commission which will be a multi-stakeholder committee.
Link the NBSAP process more closely to the National Planning Cycle	• Such a manual does not exist and the NBSAP is not utilised in national decision-making.	Correspondence from the Secretariat to the Convention on Biological

Actions Recommended in the 4th NR	Actions taken 2010-2015	Progress
• a policy manual to guide operations within a department, between departments and between departments and third parties	• The EIA regulations drafted under the Physical Planning Act offers the possibility for further mainstreaming, as the proposed Health and Environment Department will be represented on the Physical Planning Board. Also, the EIA procedures require that EIAs be reviewed by a National Environmental Appraisal Committee which will be established under the Act, and on which the Ministry of Health and Environment will be represented. Biodiversity aspects are on the list of impacts for assessment.	Diversity, dated August 14 2015, requires, through Aichi Tatrget 17, that Parties make the NBSAP a national policy instrument. It is expected that this would provide the basis for the NBSAP to become a document adopted by the Cabinet.
Adopt the Ecosystem Approach		
Address biodiversity in the Poverty Reduction Strategy Paper	The 2003 Interim Poverty Reduction Strategy Paper does not make specific mention of biodiversity. However, it makes the linkage between environmental sustainability and poverty alleviation, proposes a strategy for implementing soil and water conservation measures and managing marine biodiversity in relation to job creation in the agricultural sector, and includes environmental protection as an aspect of public education in relation to job creation in the tourism sector.	

As noted previously, "biodiversity mainstreaming is the process of embedding biodiversity considerations into policies, strategies and practices of key public and private actors that impact or rely on biodiversity." This is a task that is neither easily nor quickly achieved – it takes careful, comprehensive, strategic planning and systematic execution. It also requires that all stakeholders understand and accept the vision and are fully engaged with the process, and that there is political will to achieve the desired results.

At this stage St.Vincent and the Grenadines needs to articulate and execute a comprehensive strategy for mainstreaming biodiversity, including a plan for monitoring its implementation. The revised NBSAP 2015, therefore, contains such a strategy.

CHAPTER FOUR

Progress towards the 2011 – 2020 Aichi Biodiversity Targets in Relation to the National Biodiversity Targets and National Development Goals

4.0 INTRODUCTION

In recognition of the urgent need for action for biological diversity conservation, the United Nations General Assembly declared 2011-2020 as the United Nations Decade for Biodiversity. The Strategic Plan for Biodiversity 2011-2020 and the twenty Aichi Biodiversity Targets were adopted by the Conference of the Parties to the Convention on Biological Diversity in 2010 at Nagoya, Japan. The Strategic Plan 2011-2020 outlines a set of broad-based actions in support of biodiversity that are to be carried out over the decade of the plan, by all countries and stakeholders. A list of the twenty Aichi Biodiversity Targets is provided in Appendix 3.

4.1 National Biodiversity Targets

The 11th Conference of the Parties urged Parties to develop national targets, using the Strategic Plan for Biodiversity 2011–2020 and the Aichi Targets as a guiding framework. Parties were also required to review and, as appropriate, update and revise their National Biodiversity Strategy and Action Plans or equivalent mechanisms in line with the Strategic Plan (and in accordance with national priorities and capacities), by integrating their National Biodiversity Targets into National Biodiversity Strategy and Action Plans.

It was during the current process of revising the NBSAP and preparing the 5th National Report to the UNCBD that St. Vincent and the Grenadines selected those Aichi Targets on which they would base their National BiodiversityTargets. The Aichi Targets are 1, 5, 9, 11 and 15 (see Table 22 below). To date St. Vincent and the Grenadines has not been able to conduct a comprehensive, quantitative inventory of all its natural habitats, nor the extent and rate of degradation and fragmentation. Consequently, there is no baseline against which the Aichi Target 5 can be measured and implemented. Consequently, the corresponding National Target 2 (Aichi Target 5) has been adjusted to respond to existing national circumstances (See Table 22).

At this stage, the requirement is for St. Vincent and the Grenadines to demonstrate how these selected targets relate to broader national development goals, and to elaborate a strategy for achieving the selected targets by 2020. To this end, the following section provides a brief overview of

the National Economic and Social Developent Plan and linkages with biodiversity conservation.

Table 22. National Biodiversity Targets and Corresponding Aichi Targets

National Target 1 By 2020, at least 50% of the population of St. Vincent and the Grenadines is knowledge-able about the values of biodiversity and the steps they can take to conserve and use it sustainably.	**Aichi Target 1** **The same**
National Target 2 Note By 2020 St. Vincent would have completed studies to quantitatively establish the status of all natural habitats and the rate of habitat loss, including forest, and would have developed and in the process a strategy to rduce the rate of habitat loss.	**Aichi Target 5** By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.
National Target 3 By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	**Aichi Target 9** **The same**
National Target 4 By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.	**Aichi Target 11** **The same**
National Target 5 By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	**Aichi Target 15** **The same**

4.2 National Economic and Social Development Plan 2013-2025

In 2013, St. Vincent and the Grenadines completed a four-year national consultative process that led to the development of the National Economic and Social Development Plan (NESDP) 2013-2025. The NESDP is perhaps the most comprehensive strategy that can act as an instrument for cross-sectoral integration of biodiversity. It is intended to be the primary document that will guide economic and social development in St. Vincent and the Grenadines between 2013 and 2025. The Plan outlines the country's long-term strategies for national development, and offers a vision for improving the quality of life for all Vincentians. It is anchored on the achievement of the following 5 strategic goals:

1. Re-engineering Economic Growth
2. Enabling Increased Human and Social Development
3. Promoting Good Governance, Citizen Security and Increasing the effectiveness of Public Administration
4. Improving Physical Infrastructure and Preserving the Environment
5. Building National Pride, Identity and Culture

Of particular relevance to the Convention on Biological Diversity is goal four (4): ***Improving physical infrastructure, preserving the environment and mitigating the impact of climate change***. Objectives 4.1, 4.7, 4.8, and 4.10 of Goal 4 are as follows:

Objective 4.1: To optimise the use of limited land space.

Objective 4.7: To conserve the natural resources of the country through effective utilisation and management.

Objective 4.8: To ensure a clean, safe and healthy environment.

Objective 4.10: To reduce the adverse impact of climate change.

Table 23 shows the linkage between the national targets and the listed objectives of National Development Goal #4, and sets out specific actions that need to be taken to achieve the targets.

Table 23. St. Vincent and the Grenadines' National Biodiversity Targets: Implementation Strategy and Relevance to National Development Goals

Aichi Target	SVG National Target	Relevance to National Development Goals	National Actions that Support the Target	Actions needed to Achieve Target by 2020
1	By 2020, at least 50% of the population of St. Vincent and the Grenadines is knowledgeable about the values of biodiversity and the steps they can take to conserve and use it sustainably.	Education is a cross-cutting theme relevant to the NESDP and NBSAP. It builds awareness among policy makers and across all sectors. A notable outcome of Objective 4.7 of Goal 4 of the NESDP is: Increased community awareness and involve-ment in protection and management of resources.	• Education and Communication Units of the Ministries of Agriculture and Health & the Environment: daily and weekly public awareness programmes on relevant topics • The Forestry Department: schools' outreach programme. • The Fisheries Division: awareness of the importance of turtles, and the negative impacts of lionfish on marine biodiversity.	• Harmonise the educational and public awareness programmes of various agencies to focus on this national target • Conduct a national KAP survey before the launch of the educational programme and near the end of the plan period to evaluate the extent to which the target has been met.
5	By 2020 St. Vincent and the Grenadines would have completed studies to quantitatively establish the status of all natural habitats and the rate of habitat loss, including forest, and would have developed and be in the process of implementing a strategy to rduce the rate of habitat loss.	*Goal 4 Objective 4.7:* To conserve the natural resources if the country through effective utilis-ation and management. *Some outcomes:* Reduced deforestation; improved management; increased community awareness; improved database for preserv-ation of biodiversity	• A number of Wildlife and Forest Reserves have already been established, including the St. Vincent Parrot Reserve. • Other land-based, coastal and marine protected areas (PAs) are proposed. This will increase the acreage uneer Pas, and management is expected to reduce biodiversity loss.	• Design and implement the baseline study on habitats • Develop and implement the strategy and specific activities for reducing habitat loss
9	By 2020, invasive alien species and pathways are	Two of the Strategic Iterventions for Obj. 4.7	• Personnel of the Sustainable Grenadines Inc., the Tobago Cays Marine Park and	• Identify all invasive species of marine and

Aichi Target	SVG National Target	Relevance to National Development Goals	National Actions that Support the Target	Actions needed to Achieve Target by 2020
	identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	are: • Develop appropriate measures to restore and protect tje natural resources of the country, and • Advance research on biological resources Both of these interventions are a necessary part of this National Biodiversity Target.	Mustique Company Ltd. received training in handling lionfish and have conducted limited public education and outreach. • The dive operators of St. Vincent and the Grenadines are actively hunting lionfish. • The Fisheries Division drafted A Lionfish Action Plan in 2012 but it has not yet been implemented. • Although lionfish populations are thought to be relatively controlled at the main dive sites, the invasion of speies is still considered to be a significant threat in the waters of SVG.	terrestrial fauna and flora and establish baselines on the extent of the invasion(s) • Prioritise species for eradication based, for example, on their impact on native species and livelihoods • Develop and implement eradication stetegies, ensuring systematic monitoring and documentation of the rate(s) and extent of decline up to 2020.
11	By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and	Goal 4 Objective 4.1: To optimise the use of limited land space. Protected areas must be included in any nat6ional land use policy. A notable Outcome of this Obj. Is: A better coordinated land-use policy. Also, the following key strategic interventions relate to protected areas: Develop a comprehensive system for sustainable manage of land resources;	• St. Vincent and the Grenadines has signed on to the Caribbean Challenge Initiative (CCI) and pledged to protect 20% of its near shore marine and coastal resources by 2020. • The Tobago Cays Marine Park has been established. • Development of a new Marine Management Area in the South Coast of the mainland is underway. This activity is being led by the Fisheries Division with cross-sectoral collaboration with the Ministry of Health and the Environ-ment, Ministry of Tourism, Forestry Department and the	• Conduct assessments of the terrestrial and coastal and marine ecosystems to establish the percentage of territory that is most beneficial and feasible for protection, as well as the most appropriate level/category of protection needed. • Develop and implement, on a phased basis, the process to Protected Area designation,

Aichi Target	SVG National Target	Relevance to National Development Goals	National Actions that Support the Target	Actions needed to Achieve Target by 2020
	integrated into the wider landscapes and seascapes.	enhance capacity for land management; preserve critical forest areas	Coast Guard. • A National Oceans Governance Framework has been submitted to Cabinet. This legislation is expected enable the legal and institutional arrangements that will enhance management of the State's ocean and marine resources.	ensuring enforcement of the relevant legislation.
15	By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	Goal 4 Obj 4.10 states: To reduce the adverse impacts of climate change. It calls for inter-ventions to, among others, increase public awareness; minimise damage to beach and shoreline integrity and marine ecosystems; and develop legislative and regulatory framework for proper environmental management, and institutional systems for responding and mitigate-ing effects of climate change.	SVG's Initial National Communications to the UNFCCC was submitted in 2000 and in 2002 a draft National Climate Change Adaptation Policy Paper (NCCAPP) was produced as one of the outputs of the regional project: Caribbean Planning for Adaptation to Climate Change (Government of SVG, 2011). The NCCAPP highlighted the potential impacts of Climate Change on various sectors including coastal and marine, agriculture and forestry, socioeconomic development and others, and attempted to integrate climate change concerns into the development plans of the relevant sectors/ministries.	Conclude and legally adopt a national policy on climate change, including strategies for adaptation and mitigation. Conduct baseline studies on carbon sequestration by various ecosystems (forests, coastal and marine). Monitor ecosystem change and corresponding carbon sequestration changes in order to compile data to facilitate reporting on contributions to mitigation.

CONCLUSION

St. Vincent and the Grenadines is currently undertaking the revision of its NBSAP, which is expected to be completed in 2015. An outcome of the preparation of this 5th National Report to the UNCBD and the revision to the NBSAP is the finalisation of the national biodiversity conservation targets in alignment with the global Aichi Biodiversity Targets. The relevance of the targets to national development is borne out in Strategic Goal 4 of the recently completed National Economic and Social Development Plan 2013-2025 as shown in the preceding section of this report. This linkage is a valuable entry point for ensuring that the National Biodiversity Targets and the revised NBSAP are easily mainstreamed into national plans and activities of the various stakeholder agencies.

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APPENDIX 1: Bird Species of St Vincent and the Grenadines

Scientific Names	Common Name(s)	Scientific Names	Common Name(s)
Actitis macularia	Spotted Sandpiper	*Charadrius collaris*	Collared Plover
Allenia fusca	Scaly-breasted Thrasher	*Charadrius melodus*	Piping Plover
Amazona guildingii	St. Vincent Parrot	*Charadrius semipalmatus*	Semipalmated Plover
Anas acuta	Northern Pintail	*Charadrius vociferus*	Killdeer
Anas Americana	American Wigeon	*Charadrius wilsonia*	Wilson's Plover
Anas bahamensis	White-cheeked Pintail	*Chlidonias niger*	Black Tern
Anas clypeata	Northern Shoveler	*Chordeiles gundlachii*	Antillean Nighthawk
Anas crecca	Green-winged Teal	*Chordeiles minor*	Common Nighthawk
Anas discors	Blue-winged Teal	*Chroicocephalus ridibundus*	Black-headed Gull
Anas platyrhynchos	Mallard	*Cinclocerthia ruficauda*	Brown Trembler
Anous stolidus	Brown Noddy	*Coccyzus americanus*	Yellow-billed Cuckoo
Ardea alba	Great Egret	*Coccyzus minor*	Mangrove Cuckoo
Ardea Herodias	Great Blue Heron	*Coereba flaveola*	Bananaquit
Arenaria interpres	Ruddy Turnstone	*Colinus cristatus*	Crested Bobwhite
Aythya collaris	Ring-necked Duck	*Columba livia*	Rock Pigeon
Bartramia longicauda	Upland Sandpiper	*Columbina passerina*	Common Ground-dove
Bubulcus ibis	Cattle Egret	*Crotophaga ani*	Smooth-billed Ani
Buteo platypterus	Broad-winged Hawk	*Cypseloides niger*	Black Swift
Buteogallus anthracinus	Common Black-hawk	*Dendrocygna autumnalis*	Black-bellied Whistling-duck
Butorides virescens	Green Heron	*Dendrocygna bicolor*	Fulvous Whistling-duck
Cairina moschata	Muscovy Duck	*Dendroica caerulescens*	Black-throated Blue Warbler
Calidris alba	Sanderling	*Dendroica coronate*	Yellow-rumped Warbler
Calidris bairdii	Baird's Sandpiper	*Dendroica palmarum*	Palm Warbler
Calidris ferrugine	Curlew Sandpiper	*Dendroica pensylvanica*	Chestnut-sided Warbler
Calidris fuscicollis	White-rumped Sandpiper	*Dendroica petechial*	Yellow Warbler
Calidris mauri	Western Sandpiper	*Dendroica tigrina*	Cape May Warbler
Calidris melanotus	Pectoral Sandpiper	*Dolichonyx oryzivorus*	Bobolink
Calidris minutilla	Least Sandpiper	*Egretta caerulea*	Little Blue Heron
Calidris pusilla	Semipalmated Sandpiper	*Egretta garzetta*	Little Egret
Casmerodius albus	Great Egret	*Egretta gularis*	Western Reef-Heron
Catharopeza bishopi	Whistling Warbler	*Egretta thula*	Snowy Egret
Catoptrophorus semipalmatus	Willet	*Egretta tricolor*	Tricolored Heron
Ceryle alcyon	Belted Kingfisher	*Elaenia flavogaster*	Yellow-bellied Elaenia
Chaetura brachyuran	Short-tailed Swift	*Elaenia martinica*	Caribbean Elaenia
Chaetura martinica	Lesser Antillean Swift	*Eulampis holosericeus*	Green-throated Carib
Eulampis jugularis	Purple-throated Carib	*Orthorhyncus cristatus*	Antillean Crested Hummingbird
Euphonia musica	Antillean Euphonia	*Oxyura jamaicensis*	Ruddy Duck
Falco columbarius	Merlin	*Pandion haliaetus*	Osprey
Falco peregrinus	Peregrine Falcon	*Parula americana*	Northern Parula
Falco sparverius	American Kestrel	*Passer domesticus*	House Sparrow
Fregata magnificens	Magnificent Frigatebird	*Patagioenas leucocephala*	White-crowned Pigeon
Fulica Americana	American Coot	*Patagioenas squamosa*	Scaly-naped Pigeon
Fulica caribaea	Caribbean Coot	*Pelecanus occidentalis*	Brown Pelican
Gallinago delicata	Wilson's Snipe	*Petrochelidon fulva*	Cave Swallow
Gallinago gallinago	Common Snipe	*Petrochelidon pyrrhonota*	Cliff Swallow
Gallinula chloropus	Common Moorhen	*Phaethon aethereus*	Red-billed Tropicbird
Gallus gallus	Red Junglefowl	*Phaethon lepturus*	White-tailed Tropicbird
Gelochelidon nilotica	Gull-billed Tern	*Pheucticus ludovicianus*	Rose-breasted Grosbeak
Geotrygon montana	Ruddy Quail-Dove	*Piranga olivacea*	Scarlet Tanager
Haematopus palliatus	American Oystercatcher	*Piranga rubra*	Summer Tanager
Himantopus mexicanus	Black-necked Stilt	*Plegadis falcinellus*	Glossy Ibis
Hirundo rustica	Barn Swallow	*Pluvialis dominica*	American Golden Plover
Icterus galbula	Baltimore Oriole	*Pluvialis squatarola*	Black-bellied Plover/Grey Plover
Ixobrychus exilis	Least Bittern	*Podilymbus podiceps*	Pied-billed Grebe

Larus atricilla	Laughing Gull	*Porphyrio martinica*	Purple Gallinule
Larus delawarensis	Ring-billed Gull	*Porzana Carolina*	Sora
Limnodromus griseus	Short-billed Dowitcher	*Progne dominicensis*	Caribbean Martin
Limosa fedoa	Marbled Godwit	*Protonotaria citrea*	Prothonotary Warbler
Loxigilla noctis	Lesser Antillean Bullfinch	*Puffinus lherminieri*	Audubon's Shearwater
Micropalama himantopus	Stilt Sandpiper	*Puffinus puffinus*	Manx Shearwater
Mimus gilvus	Tropical Mockingbird	*Quiscalus lugubris*	Carib Grackle
Mniotilta varia	Black-and-white Warbler	*Riparia riparia*	Bank Swallow/Sand Martin
Molothrus bonariensis	Shiny Cowbird	*Seiurus aurocapillus*	Ovenbird
Myadestes genibarbis	Rufous-throated Solitaire	*Seiurus motacilla*	Louisiana Waterthrush
Myiarchus nugator	Grenada Flycatcher	*Seiurus noveboracensis*	Northern Waterthrush
Numenius americanus	Long-billed Curlew	*Setophaga castanea*	Bay-breasted Warbler
Numenius borealis	Eskimo Curlew	*Setophaga ruticilla*	American Redstart
Numenius phaeopus	Whimbrel	*Setophaga striata*	Blackpoll Warbler
Nyctanassa violacea	Yellow-crowned Night-heron	*Sicalis luteola*	Grassland Yellow-finch
Nycticorax nycticorax	Black-crowned Night-heron	*Sporophila nigricollis*	Yellow-bellied Seedeater
Oceanites oceanicus	Wilson's Storm-Petrel	*Stercorarius parasiticus*	Parasitic Jaeger
Onychoprion *anaethetus*	Bridled Tern	*Stercorarius pomarinus*	Pomarine Jaeger
Onychoprion fuscata	Sooty Tern	*Sterna antillarum*	Least Tern
Ortalis ruficauda	Rufous-vented Chachalaca	*Sterna dougallii*	Roseate Tern
Sterna forsteri	Forster's Tern	*Troglodytes aedon*	House Wren
Sterna hirundo	Common Tern	*Tryngites subruficollis*	Buff-breasted Sandpiper
Sula dactylatra	Masked Booby	*Turdus fumigatus*	Cocoa Thrush
Sula leucogaster	Brown Booby	*Turdus nudigenis*	Bare-eyed Robin
Sula sula	Red-footed Booby	*Tyrannus dominicensis*	Gray Kingbird
Tangara cucullata	Lesser Antillean Tanager	*Tyrannus savana*	Fork-tailed Flycatcher
Thalasseus maximus	Royal Tern	*Tyto alba*	Barn Owl
Thalasseus sandvicensis	Sandwich Tern	*Vireo altiloquus*	Black-whiskered Vireo
Tiaris bicolor	Black-faced Grassquit	*Vireo flavifrons*	Yellow-throated Vireo
Tringa flavipes	Lesser Yellowlegs	*Wilsonia citrina*	Hooded Warbler
Tringa melanoleuca	Greater Yellowlegs	*Zenaida auriculata*	Eared Dove
Tringa solitaria	Solitary Sandpiper	*Zenaida aurita*	Zenaida Dove

APPENDIX 2: St. Vincent and the Grenadines Species Listed on the IUCN Species Survival Commission's List of One Hundred World's Worst Invasive Alien Species

Scientific Name	Common Name(s)	Comments
*Rhinella marina (*Formerly *Bufo marinus)*	Cane/Marine toad	Cane toads were introduced to many countries as biological control agents for various insect pests of sugarcane and other crops. The cane toads have proved to be pests themselves. They will feed on almost any terrestrial animal and compete with native amphibians for food and breeding habitats. Their toxic secretions are known to cause illness and death in domestic animals that come into contact with them, such as dogs and cats, and wildlife, such as snakes and lizards. Human fatalities have been recorded following ingestion of the eggs or adults.
Anopheles quadrimaculatus	Common Malaria mosquito	*Anopheles quadrimaculatus* is a chief vector of malaria. This species prefers habitats with well-developed beds of submergent, floating leaf or emergent aquatic vegetation. Larvae are typically found in sites with abundant rooted aquatic vegetation, such as rice fields and adjacent irrigation ditches, freshwater marshes and the vegetated margins of lakes, ponds and reservoirs.
Capra hircus	Goat	The goat *Capra hircus* was domesticated 10,000 years ago in the highlands of western Iran. These herbivores have a highly varied diet and are able to utilize a larger number of plant species than other livestock. Goats alter plant communities and forest structure and threaten vulnerable plant species. The reduction of vegetation reduces shelter options for native animals, and overgrazing in native communities leads to ecosystem degradation. Feral goats spread disease to native animals. Native fauna on islands are particularly susceptible.
Cecropia peltata	Trumpet bush	*Cecropia peltata* is a fast-growing, short-lived tree that grows in neotropical regions. It is light-demanding and rapidly invades disturbed areas, such as forest canopy gaps, roadsides, lava flows, agricultural sites, urban locations, and other disturbed areas. It naturally occurs in tropical Central and South America, as well as some Caribbean islands and has been introduced to Malaysia, Africa, and Pacific Islands. It may be replacing, or competing with, other native pioneer species in some locations.
Coptotermes formosanus	Formosa termite	*C. formosanus* will hollow out live trees and not just dead ones. Some colonies will also nest in homes and other structures instead of just dining on them (Raloff, 2003). The presence of *C. formosanus* can easily go unnoticed for long periods of time. Infestations may not be noticed until floorboards become squishy or visible signs of the colony burrowing out through plaster walls become apparent (Raloff, 2003). Hu and Zhu (2003) found that in the wild *C. formosanus* could not hybridise with other termite species. This species is very aggressive and will out compete native

Scientific Name	Common Name(s)	Comments
		species of termites with ease.
Felis cattus	Domestic cat	*Felis cattus* was domesticated in the eastern Mediterranean c. 3000 years ago. Considering the extent to which cats are valued as pets, it is not surprising that they have since been translocated by humans to almost all parts of the world. Notable predators, cats threaten native birdlife and other fauna, especially on islands where native species have evolved in relative isolation from predators.
Eichhornia crassipes	Water hyacinth	Originally from South America, *Eichhornia crassipes* is one of the worst aquatic weeds in the world. Its beautiful, large purple and violet flowers make it a popular ornamental plant for ponds. It is now found in more than 50 countries on five continents. Water hyacinth is a very fast growing plant, with populations known to double in as little as 12 days. Infestations of this weed block waterways, limiting boat traffic, swimming and fishing. Water hyacinth also prevents sunlight and oxygen from reaching the water column and submerged plants. Its shading and crowding of native aquatic plants dramatically reduces biological diversity in aquatic ecosystems.
Herpestes auropunctatus	Small Indian mongoose	The small Indian mongoose *Herpestes auropunctatus* has been introduced to many islands worldwide for control of rats and snakes, mainly in tropical areas, but also to islands in the Adriatic Sea. Moreover, it has been introduced successfully in two continental areas: the northeast coast of South America and a Croatian peninsula. Mongooses are diurnal generalist carnivores that thrive in human-altered habitats. Predation by mongoose has had severe impacts on native biodiversity leading to the decline and extirpation of native mammals, birds, reptiles, and amphibians. At least seven species of native vertebrates, including mammals, birds, reptiles, and amphibians, have almost disappeared on Amami-oshima Island since the introduction of the mongoose in 1979. In addition, mongoose carries human and animal diseases, including rabies and human *Leptospira bacterium*.
Mus musculus	House mouse	The house mouse *Mus musculus* probably has a world distribution more extensive than any mammal, apart from humans. Its geographic spread has been facilitated by its commensal relationship with humans, which extends back at least 8,000 years. They cause considerable damage to human activities by destroying crops and consuming and/or contaminating food supplies intended for human consumption. They are prolific breeders, sometimes erupting and reaching plague proportions. They have also been implicated in the extinction of indigenous species in ecosystems they have invaded and colonised. An important factor in the success of *M.*

Scientific Name	Common Name(s)	Comments
		musculus is its behavioural plasticity brought about by the decoupling of genetics and behaviour. This enables *M. musculus* to adapt quickly and to survive and prosper in new environments.
Rattus rattus	Black rat/Ship rat	A native of the Indian sub-continent, the ship rat *Rattus rattus* has now spread throughout the world. It is widespread in forest and woodlands as well as being able to live in and around buildings. It will feed on and damage almost any edible thing. The ship rat is most frequently identified with catastrophic declines of birds on islands. It is very agile and often frequents treetops searching for food and nesting there in bunches of leaves and twigs. The ship rat has directly caused or contributed to the extinction of many species of wildlife including birds, small mammals, reptiles, invertebrates, and plants, especially on islands. Ship rats are omnivorous and capable of eating a wide range of plant and animal foods. These include native snails, beetles, spiders, moths, stick insects and cicadas and the fruit of many different plants (Innes 1990). They also prey on the eggs and young of forest birds (Innes et al., 1999). In the recovery programme for the endangered Rarotonga flycatcher or kakerori (see *Pomarea dimidiata* in the IUCN Red List of Threatened Species), Robertson et al. (1994) identified ship rats as the most important predator affecting the breeding success of this bird. Several cases are known where predation on seabirds can be reliably attributed to ship rats. These include sooty terns (see *Sterna fuscata* in IUCN Red List of Threatened Species) in the Seychelles Islands (Feare, 1979), Bonin petrels (see *Pterodroma hypoleuca* in IUCN Red List of Threatened Species) in Hawai'i (Grant et al., 1981), Galapagos dark-rumped petrels (see *Pterodroma phaeopygia* in IUCN Red List of Threatened Species) in the Galapagos Islands (Harris, 1970), and white-tailed tropicbirds (see *Phaethon lepturus* in IUCN Red List of Threatened Species) in Bermuda (Gross, 1912).
Pueraria montana	Kudzu vine	Kudzu is widely believed to drastically reduce biodiversity because of its ability to smother other vegetation and develop large-scale monocultures (Alderman 1998; Forseth and Innis 2004, in Sun et al. 2006). It can climb overtop and subsequently kill new seedlings or mature trees (Berisford, Bush andand Taylor 2006). Forestry problems associated with aggressive vines such as kudzu include mortality of edge trees, exclusion of native plant species, and potential to increase fire hazard during winter (Putz 1991, in Harrington Rader-Dixon & Taylor 2003). Kudzu constrains urban, suburban, and rural development in highly infested areas (Blaustein 2001). Eradication and clearing must occur to safeguard open space, parks, structures, and buildings.
Spathodea campanulata	African tulip tree	The African tulip tree *Spathodea campanulata* is an evergreen tree native to West Africa. It has

Scientific Name	Common Name(s)	Comments
		been introduced throughout the tropics, and, has naturalised in many parts of the Pacific. It favours moist habitats and will grow best in sheltered tropical areas. It is invasive in Hawaii, Fiji, Guam, Vanuatu, the Cook Islands and Samoa, and is a potential invader in several other tropical locations. The African tulip tree invades agricultural areas, forest plantations and natural ecosystems, smothering other trees and crops as it grows becoming the prevailing tree in these areas (Labrada, pers.comm. 25 February 2003). In Hawaii, there are major infestations tucked away in almost every rainforest valley along the northern and eastern slopes of Kaua'I, O'ahu, and East Maui (Smith, Hawai'ian Alien Plant Studies).
Sphagneticola trilobata	Wedelia	Although *Sphagneticola trilobata* is the accepted name for this species, it is widely known as *Wedelia trilobata*. *Sphagneticola trilobata* is native to the tropics of Central America and has naturalised in many wet tropical areas of the world. Cultivated as an ornamental, it readily escapes from gardens and forms a dense ground cover, crowding out or preventing regeneration of other species. In plantations, it will compete with crops for nutrients, light and water, and reduce crop yields. If *Sphagneticola trilobata* becomes established in plantations, it will compete with crops for nutrients, light and water, and reduce crop yields. It rapidly escapes from gardens to roadsides and plantations, where it can overgrow plants and develop into a thick cover (Niue DAFF, 2001). Forms a dense ground cover, crowding out or preventing regeneration of other species (PIER, 2003).
Lantana camara	Lantana	*Lantana camara* is a significant weed of which there are some 650 varieties in over 60 countries. It is established and expanding in many regions of the world, often as a result of clearing of forest for timber or agriculture. It impacts severely on agriculture as well as on natural ecosystems. The plants can grow individually in clumps or as dense thickets, crowding out more desirable species. In disturbed native forests it can become the dominant understorey species, disrupting succession and decreasing biodiversity. At some sites, infestations have been so persistent that they have completely stalled the regeneration of rainforest for three decades. Its allelopathic qualities can reduce vigour of nearby plant species and reduce productivity in orchards. *Lantana camara* has been the focus of biological control attempts for a century, yet still poses major problems in many regions.
Leucaena leucocephala	Leucaena	The fast-growing, nitrogen-fixing tree/shrub *Leucaena leucocephala*, is cultivated as a fodder plant, for green manure, as a windbreak, for reforestation, as a biofuel crop etc. Leucaena has been

Scientific Name	Common Name(s)	Comments
		widely introduced due to its beneficial qualities; it has become an aggressive invader in disturbed areas in many tropical and sub-tropical locations and is listed as one of the '100 of the World's Worst Invasive Alien Species'. This thornless tree can form dense monospecific thickets and is difficult to eradicate once established. It renders extensive areas unusable and inaccessible and threatens native plants.

Source: Adapted from http://www.issg.org/worst100_species.html. See site also for references contained in the table.

APPENDIX 3: The Aichi Biodiversity Targets

Strategic Goal A: *Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society*

›› **Target 1:** By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and useit sustainably.

›› **Target 2:** By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.

›› **Target 3:** By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.

›› **Target 4:** By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.

Strategic Goal B: *Reduce the direct pressures on biodiversity and promote sustainable use*

›› **Target 5:** By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.

›› **Target 6:** By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.

›› **Target 7:** By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.

›› **Target 8:** By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.

›› **Target 9:** By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

›› **Target 10:** By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.

Strategic Goal C: *Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity*

›› **Target 11:** By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especiallyareas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascapes.

›› **Target 12:** By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

›› **Target 13:** By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.

Strategic Goal D: *Enhance the benefits to all from biodiversity and ecosystem services.*

›› **Target 14:** By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

›› **Target 15:** By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

›› **Target 16:** By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.

Strategic Goal E: *Enhance implementation through participatory planning, knowledge management and capacity building*

›› **Target 17:** By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.

›› **Target 18:** By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.

›› **Target 19:** By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.

›› **Target 20:** By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan 2011-2020 from all sources and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization should increase substantially from the current levels. This target will be subject to changes contingent to resources needs assessments to be developed and reported by Parties.