PAPER

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CLIMATE CHANGE AND BIODIVERSITY IN ST. VINCENT AND THE GRENADINES

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ABSTRACT: The paper will attempt to show the current status of climate change and biological diversity along with identifying the present and potential impacts to the forest biodiversity in St. Vincent and the Grenadines from global climate change including ENSO phenomenon, invasive species, hurricanes, forest fires and land degradation. The paper defines Climate Change and Biodiversity in addition to linking their relationships and effects on St. Vincent and the Grenadines. Furthermore, the current status of climate change and forest biodiversity monitoring, by including a list of endemic species in St. Vincent and the Grenadines, is provided. The Paper: (1) identifies the impacts on forest biodiversity from global climate change by indicating key issues of the recent Knowledge, Attitude, Practices (KAP) Survey 2007 done in Union Island, Bequia and Spring Village (communities in St. Vincent and the Grenadines); and state current and potential adverse impacts of climate change on Biodiversity such as changes in flowering of the forest species; migration/ succession of forest types, vegetation and fauna; damage/destruction of habitat due to change in temperature and rainfall; and changes in predator/prey relationship, which in turn will affect agriculture and human health; (2) identifies research areas that will provide pertinent information; this is due to the lack of scientific evidence for implementing adaptation strategies aimed at providing environmental and socio-economic sustainability. Such research will focus on options, interactions and synergies between global climate change and forest biodiversity; and (3) provides present and future networks including the Second National Communications Project to the UNFCCC, which was launched in October 2006 and one of its main components being to conduct vulnerability and adaptation assessments of our major productive sectors, inclusive of forest biodiversity. The assessments start at the end of 2007 and are expected to be completed by 2008; and highlight existing regional agencies focusing on climate change and its adverse effects that will assist in giving technical and other support to regional countries on addressing climate change issues along with providing assistance to research projects. Preparing the paper was done using existing documents on the topic done locally, regionally and internationally. In addition, informal interviews were held with individuals from relevant government ministries and other agencies in St. Vincent and the Grenadines. Information in the paper focuses mainly on the effects of climate change and biodiversity on the terrestrial environment within St. Vincent with minimal comparative effects on the Grenadines. It will give information on five endemics. Also, the limited quantity of documented information and adequate research on the effects of climate change on biodiversity in SVG limits the information available. The paper lists the effects caused by the adverse impacts of climate change on forest biodiversity. It also shows the commonality in habitat loss, collateral damage and survival of the fittest of the species in the forest environment.

Keywords: climate change, biodiversity, Caribbean

1. Introduction

St. Vincent and the Grenadines is a multiple island nation consisting of 32 islands and cays located in the Eastern Caribbean. The total land area is approximately 389 square kilometers or 38.694 hectares. St. Vincent is the largest and main island with a size of 344 square kilometers or 34.462 hectares. The Grenadines consist of a number of privately and state-owned islands with Bequia, Mustique, Canouan, Mayreau, Union Island, Palm Island and Petit St. Vincent being inhabited. Four other islands make up the Tobago Cays Marine Park. St. Vincent and the Grenadines' human population is 100,747 from the last population census in 2005. The islands form part of the Windward Islands, and are located between St. Lucia to the north and Grenada to the south, and 100 miles west of Barbados. St. Vincent is very mountainous in nature with one of the world's largest active volcanoes (La Soufrière) – its highest point, rising to over 4,000 feet- and the second oldest Forest Reserve in the Western Hemisphere, the Kings Hill Forest Reserve established in 1791. The Grenadines in contrast, consist of low dry islands surrounded by extensive coral reefs. Average annual rainfall in St. Vincent ranges from 1,200 mm on the dry coast to 7,000 mm in the wet central mountains. In contrast, the Grenadines may experience as little as 460 mm per annum (Simmons and Associates *Inc.*, 2000).

St. Vincent and the Grenadines has a diverse collection of biological resources. It is very mountainous and fertile and has a significant tropical rainforest that provides the natural habitat for the St. Vincent Parrot (*Amazona guildingii*), the National Bird, and other wildlife. Collectively, more than 1,150 species of flowering plants, 163 species of ferns, 4 species of amphibians, one of which is endemic (Henderson *et al,* 2007), 14 species of reptiles, 111 species of birds and 15 species of mammals have been identified within St. Vincent and the Grenadines (Anthony, 1997). As on most West Indian Islands, threats to native species include pollution, habitat loss as a result of agriculture, urbanization, and development for tourism, and predation by, competition with, or habitat damage attributed to introduced species (especially mongooses, feral cats, rats, dogs, goats, and invasive reptiles and amphibians). The marine biodiversity has been given a lot of attention with the establishment of the Tobago Cays Marine Park, located in the Grenadines. Conservation programs fall under the Ministry of Agriculture, Forestry and Fisheries, with terrestrial systems primarily under the Department of Forestry. The St. Vincent Parrot Reserve, established for the protection of habitats also benefits other species that rely on intact mature forest.

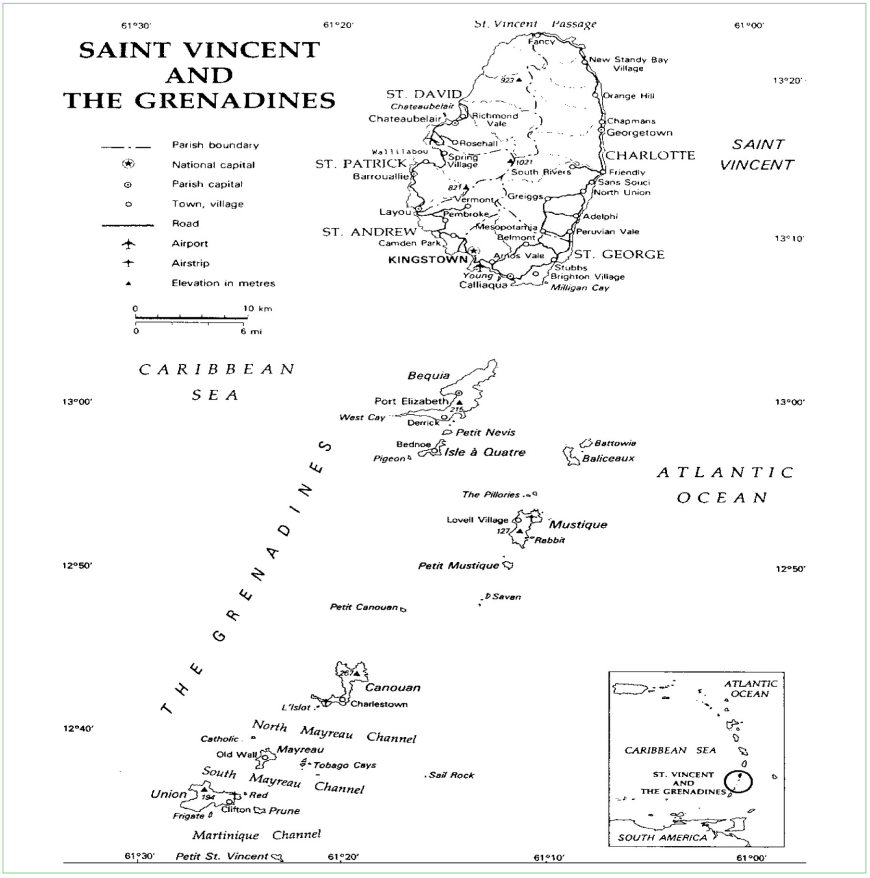


FIGURE 1
Country Map for St. Vincent and the Grenadines (Source: GSVG, 1986b. In CCA, 1990).

2. Climate Change and Biodiversity

According to the United Nations Framework Convention on Climate Change (UNFCCC), Climate Change is defined as: *"a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is observed, in addition to natural climate variability, over comparative time periods."* Climate Change is projected to affect all aspects of biodiversity. The changes however, have to take into account the impacts from other past, present, and future human activities including increasing atmospheric concentrations of greenhouse gases especially carbon

dioxide (CO_2) and natural systems. The ENSO phenomenon in a given year is associated with increase air temperatures when compared to a normal year (non-ENSO) or a La Niña year. This increase in air temperatures is most likely to lead to adverse effects on biological diversity. Such adverse effects include species migration, loss of micro and macro soil organisms, restrictions in species ability to adapt to excess heat, and ultimately species being endangered or death. An increase of global air temperature between 1.5 to 2.0 degrees Celsius can lead to adverse impacts such as an increase in evaporation losses, general increase in extreme events (droughts, floods, excessive rainfall, etc.), and decrease in the number of raindays while at the same time providing an increase in the quantity of rainfall at a national level (Joyette, 2007).

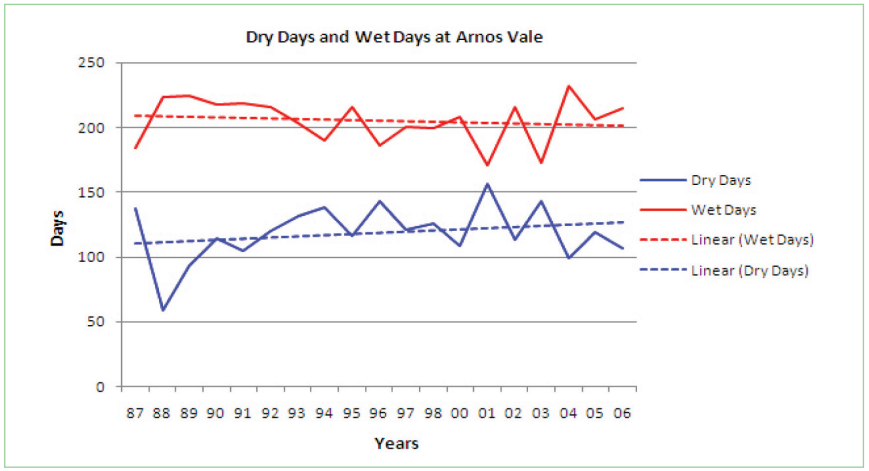


FIGURE 2
Annual Total Dry Days and Wet Days observed at Arnos Vale, St. Vincent and the Grenadines (Source: St. Vincent and the Grenadines Climate Assessment, 2007).

The islands climate features are notable by heavy convective downpours, seasonal tropical synoptic systems such as tropical waves and tropical cyclones and the Inter-Tropical Conversion Zone are among the most significant ones. These features have been known to produce widespread heavy rain, floods and landslides that have resulted in considerable damage and destructions to the environment and infrastructure, and to a lesser extent, humans. Joyette (2007) observed that within the last 10 years, there appears to be a growing trend of a wetter than normal dry season in St. Vincent and the Grenadines. The current loss of forest cover can be accelerated by climate change unless immediate action is taken vis-à-vis adaptation and mitigation measures.

Biodiversity defined by the United Nations Convention on Biological Diversity (UNCBD) is: "*the variability among living organism from all sources including inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part.*"

Conservation of Biodiversity globally is enshrined in the Convention on Biological Diversity (CDB) initially signed by 154 nations at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992. The nation of St. Vincent and the Grenadines is a signatory to several multilateral environmental agreements and has other national legislation that are supportive of adaptation measures for climate change which in turn make provisions for the conservation and protection of biological diversity (*see Attachment 1*). St. Vincent and the Grenadines ratified the CBD and therefore became responsible for implementing the provisions of the Convention. A National Biodiversity Strategy and Action Plan was developed in 2000 for the protection and sustainable use of St. Vincent and the Grenadines' biodiversity in accordance with Article 6 of the CBD (*see Attachment 2*).

There are a number of legislative acts and regulations that incorporate the sustainable use of biodiversity. These include the Fisheries Act of 1986, Fisheries Regulations of 1987, Wildlife Protection Act (WPA) of 1987, Forest Resource Conservation Act (FRCA) of 1992, Town and Country Planning Act of 1992, The Marine Parks Act and Marine Parks Regulations of 1997 and 1998 respectively, and the National Parks Act of 2002, among others. The two pieces of legislation implemented by the Forestry Department within St. Vincent and the Grenadines supports the legal basis for managing its natural resources. The FRCA 1992 gives the Forestry Department the mandate for managing the nation's forests and watersheds. The WPA of 1987 provides for the protection and management of the Nation's wildlife and authorizes the establishment of wildlife reserves for that purpose. It is under this Act that the St. Vincent and the Grenadines's 24 wildlife reserves have been established. The Fisheries Act in turn provides for the management and development of fisheries as well as the protection of special areas designated as marine reserves. The implementation of measures for the conservation and sustainable use of biodiversity is incorporated into the work programmes, and operational, corporate, and management plans of the various government and non-governmental sectors and agencies. In the case of marine biodiversity, regional consultations took place in 2004 to develop a common Fisheries Policy and Regime which would include strategies to address Article 6 and 8 of the CBD.

In 1993, about 38% of the land area was covered by forest, about 5% of which was mature, mostly undisturbed primary forest. At that time, land above 305 meters sea level was reserved to conserve remaining forests (St. Vincent and the Grenadines Forestry Department, 1993). There is history of deforestation in St. Vincent and the Grenadines due to squatting and agricultural encroachment (Providence, 2000). Estimates of deforestation in some watershed areas were estimated to approach 60 – 70 acres/year (CCA. 1991). The national forest inventory of 1993 gave an average rate of deforestation as 17 ha/year, over the period 1986-1993. In 1984, Birdsey *et al.*, did an inventory of the forest in St. Vincent, which was based on photo interpretation. The map produced was an adaptation of Beard's 1949 study. The most recent inventory was done in 1993 where a National Inventory Report was produced. This inventory was based on the re-interpretation of the 1982 photographs and strip sampling points (the findings of this inventory are in Tables 1 and 2).

TABLE 1
Forest Land Classification and Areas by Inventory Year

Forest Types	Area in ha		
	1949	1984	1993
Rainforest	8218	9208	7759
Dry Scrub Woodland	1491	1326	2179
Elfin Woodland	207	952	457
Palm Brake	4122	1734	518
Regeneration			1776
Total Forest Area	**14,038**	**13,220**	**12,689**

TABLE 2
Areas of Rainforest Type

Forest Types	Area in ha
Primary Rainforest	4308
Secondary Rainforest	3451
Total Forest Area	**7759**

According to the 1993 National Inventory Report, a formal inventory has never been carried out for the Grenadines; however, visits were made for the GOSVG/CIDA forestry development project to ground-truth existing map

information. An account of the flora of the Grenadines can be found in Howard's "Vegetation of the Grenadines" published in 1952 and cited in the Country Environmental Profile of St. Vincent and the Grenadines. Forests and sustainable forest management are not only important to the Vincentian government; they also play an important role in the lives and well being of the Vincentian population. Most of the forests in St. Vincent and the Grenadines are located on government lands. Management, therefore, is done primarily through the Forestry Department. Direct national spending on the forestry sector stands just over 2.1 million Eastern Caribbean dollars annually. The forests in St. Vincent and the Grenadines are of prime importance for the national economy through ecotourism, welfare of citizens (livelihoods), and environmental conservation and management. The awareness of its economic and social importance is increasing rapidly among Vincentians.

Forests within St. Vincent and the Grenadines play a special role in the conservation of biodiversity. Within its 150 square miles, it houses hundreds of the world's plants and animals; more than thirteen of which are known to be endemic to St. Vincent and the Grenadines. In tree species alone, forests are extremely diverse, often having more than 100 species per hectare. Forests cover approximately 28 percent of the island but contribute only 0.74 percent to the national GDP. The forests support 65 percent of the national biodiversity; protect the many steep slopes from erosion, and maintain the surface water flow on which the country depends for its potable water.

3. Adverse Impacts of Climate Change on Forestry in St. Vincent and the Grenadines

The potential impacts of climate change will likely be felt most strongly in coastal areas, through mechanisms such as saltwater intrusion, increased coastal erosion, and flooding or inundation. However, the country as a whole will be more susceptible to certain impacts, particularly increased intensity of tropical storms and hurricanes, which threaten biodiversity, human life and ecosystems, and have significant impacts on the national economy. There is evidence already in St. Vincent and the Grenadines of increased incidence of extreme events such as increased rainfall events and flooding, providing a strong indication that climate variability is already adversely affecting the country. Climate change will influence terrestrial ecosystems in varying ways. The projected changes in climate can have adverse effects on water resources, agriculture, natural ecosystems and human health. The main aspects of climate change that will affect the forest biodiversity of St. Vincent and the Grenadines include: increases in global air temperatures; increased rainfall; and sea level rise.

3.1 Increases in Global Air Temperatures

The increase in global air temperatures will lead to a number of adverse effects to the forest biodiversity within St. Vincent and the Grenadines. As a result of such global increases, there is evidence that national temperatures have increased both with regards to the maximum and minimum. According to Joyette (2007), annual minimum temperatures have increased from approximately 18.8°C to approximately 21.2°C and maximum temperature from 32.7°C to 33.2°C over the last 28 year period (Figure 3). This will result in the land heating up faster than usual and not cooling as quickly. This additional heat will adversely influence terrestrial ecosystems and ultimately the biological diversity that such ecosystems support. The additional heat will also result in increased soil moisture content loss, changed soil texture and properties, and increased transpiration rate of native flora. As a result of these adverse effects, there is a high incidence for flora and fauna migration in addition to floral succession.

As the earth's temperature rises, there will also be increased heat in certain wildlife habitats thus wildlife will move towards higher elevations or different locations to find suitable habitats. For agriculture, accelerated global warming will affect atmospheric carbon dioxide concentrations, temperatures, and precipitation patterns that can change relatively wet areas to dryer areas, or wet

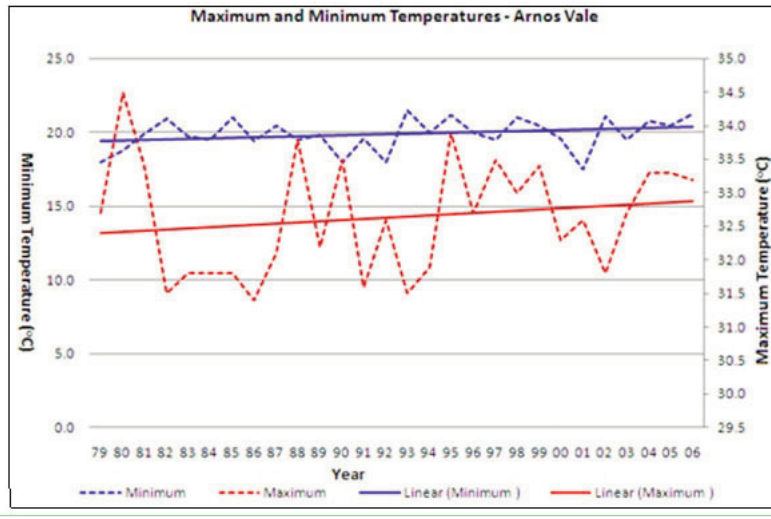


FIGURE 3
Maximum and Minimum Temperature, Arnos Vale, 1979 - 2006 (Source: St. Vincent and the Grenadines Climate Assessment, 2007).

areas to wetter areas, or dry areas to dryer areas with substantial impacts on agriculture. Therefore, higher temperatures will affect plant production which can compromise national food security. Also, due to the higher air temperatures, agriculture crops are most likely to face added stresses from increased and/or new pests and diseases, which result in other adverse effects associated with the increased use of herbicides and pesticides to control the increase in and/or new pests and diseases.

Native vegetation is expected to migrate owing to temperature change and increased precipitation, which may create problems in small island settings such as St. Vincent and the Grenadines. From a watershed perspective, there is a fluctuation in the rate of re-charge and discharge of water in the watersheds throughout St. Vincent and the Grenadines. This occurs as a result of increased air temperatures, which reduces soil moisture and increases the transpiration rate of the tree species. As a result the trees will increase their uptake of moisture from the soil and this will reduce the quantity of groundwater available to recharge the surface flow in the rivers. In addition, increases in evaporation of surface water will also cause a fluctuation in the discharge rate.

The forest biodiversity is under added pressure from resource competitors, predators, parasites, diseases and disturbances (such as fires or storms). For example, where fire is used to clear agricultural land, drier, warmer conditions will make an adjacent forest more susceptible to burning. In addition, disturbances such as fires, floods and pests are expected to become more frequent as a result of climate change. Increased rainfall events will cause increased soil erosion and soil leaching thus leading to less fertile land which will affect the production of food for daily consumption and livelihoods.

Increases in air temperature will give rise to a reduction in the incubation period of the *Aedes aegypti* mosquito by providing the environment (forested and non-forested areas) for this pest to flourish. This will cause the mosquito to mature in a shorter time thus increasing the quantity of mosquitoes, which in turn can lead to dengue fever outbreaks leading to human health issues. With the increase in temperatures, the vegetation zones are expected to move towards higher latitudes or high altitudes and in some cases depending on the rate of the temperature increase certain vegetation zones/types can become extinct. Changes in streamflow, floods, droughts, water temperature, and water quality have been observed and they have affected biodiversity and the goods and services that the ecosystems provide. Changes in rainfall frequency and intensity combined with landuse change in watershed areas have led to increased soil erosion and siltation in rivers.

The increase in global air temperature will also give rise to increase in sea surface temperatures. In coastal waters, increase in temperatures will lower the oxygen content and allow for growth of toxic algae and harmful bacteria that can destroy several species of fish. The inundation of shallow reefs and mangroves will result in loss of breeding grounds and ultimately the loss of some species. In addition, increase in sea surface temperatures is most likely to place added stress on certain species of coral reefs, which can lead to their deaths and possible extinction. Also, increase of sea surface temperatures will most likely result in a poleward shift of biological diversity especially fishes as they move to more conducive habitats.

3.2 Increased Rainfall

Joyette (2007) observed that within the last 10 years, there appears to be a growing trend of a wetter than normal dry season in St. Vincent and the Grenadines. From observation in St. Vincent and the Grenadines, the *Burgera simaruba* (gumbolimba) usually starts shedding its leaves and flowers in January, but for the past 5 years when there is continuous rainfall in January it sheds its leaves and puts out new shoots later, and when there is a dry spell in March/May it starts fruiting (Glasgow, 2007). In addition, at Argyle, along the east coast of St. Vincent, the *Coccoloba uvifera* (seaside grape), during an unusual weather system with an increase of rainfall also in January, there was a sudden flush of leaves reddish brown in color (Johnson *et al.*, 2007). According to the climate

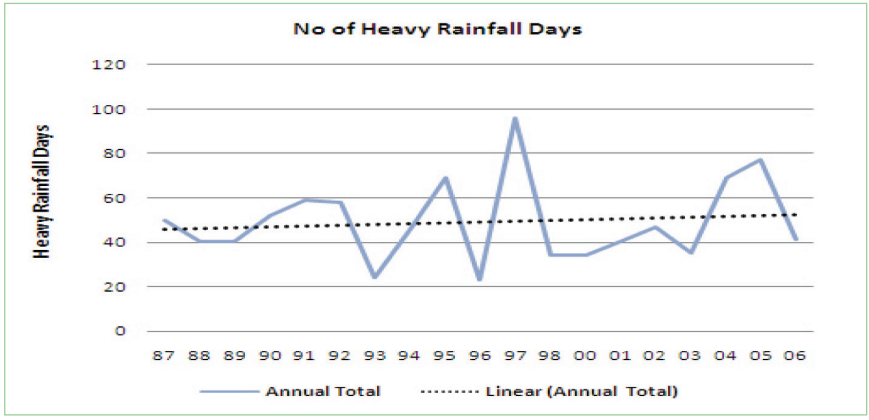
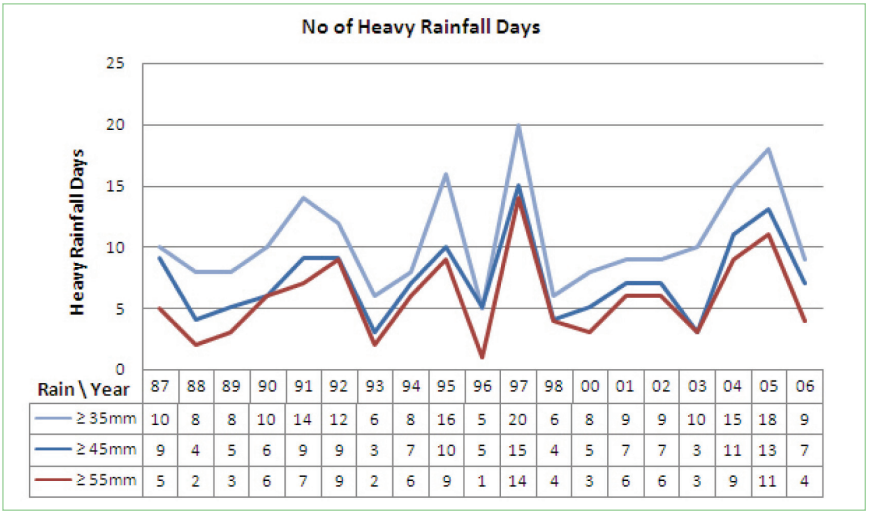


FIGURE 4
Annual total heavy rainfall days at Arnos Vale, St. Vincent and the Grenadines (Source: St. Vincent and the Grenadines Climate Assessment, 2007).

assessment of St. Vincent and the Grenadines done by Joyette (2007), the quantity of precipitation has increased while the number of raindays has decreased. This means that a larger quantity of rainfall falls in less days and this has serious implications with regards to increase surface run-off and flooding. Increased flooding events will cause damage, destruction, and dislocation of species. Frequent flooding in coastal areas is very likely to cause a change in vegetation and ultimately the flora and fauna biodiversity. Also, increase surface run-off will cause an increase in soil erosion, which in turn will lead to deposition of contaminants in fresh water and eventually this will most likely adversely affect aquatic biodiversity. With the increase in rainfall, this eventually leads to landslides and frequent flooding, seeds and other plant parts are removed and deposited in other areas starting a process of colonization of dominating species that are there. This can also be caused by wind due to more frequent storms/hurricanes. As a result, this will affect fauna behaviour in relation to food and nesting/breeding (Glasgow, 2007).



Rain \ Year	87	88	89	90	91	92	93	94	95	96	97	98	00	01	02	03	04	05	06
≥ 35mm	10	8	8	10	14	12	6	8	16	5	20	6	8	9	9	10	15	18	9
≥ 45mm	9	4	5	6	9	9	3	7	10	5	15	4	5	7	7	3	11	13	7
≥ 55mm	5	2	3	6	7	9	2	6	9	1	14	4	3	6	6	3	9	11	4

FIGURE 5
Number of heavy rainfall events at Arnos Vale, St. Vincent and the Grenadines (Source: St. Vincent and the Grenadines Climate Assessment 2007).

3.3 Sea Level Rise

As recently reported by the United Nations, the Antarctic ice/glaciers are melting twice as fast within the last 10 years, which will lead to rise in sea level. This will most likely result in a change in coastal vegetation, loss of species' habitats, loss of species, migration of wildlife especially migratory birds, dislocation of species, and disruption of the ecological balance of the coastal ecosystems. According to Johnson, there appear to be an influx of zenaida doves for the past four years seen in different parts of St. Vincent and the Grenadines. There was also an increase in the number of butterflies that however can also be attributed to the decrease in banana cultivation and less use of chemicals by the farmers.

4. Proposed Research

Due to the fact that there is a lack of scientific evidence to adequately implement adaptation strategies aimed at providing environmental and socio-economic sustainability, the following areas of research are identified:

1. Identify and describe the added stresses that the Cross Country Road (CCR) will have on the forest biodiversity bearing in mind the adverse impacts of climate change. This research will require conducting a comprehensive inventory of the biodiversity along and around the path of the CCR;
2. Research all endemic species to look at the impacts of climate change, how their habitats will be impacted, identify new threats, and determine actions (adaptation and mitigation strategies/measures) that will ensure these species survival;
3. Research introduced species such as the Armadillo (Tattoo), Agouti, etc. about the impact of climate change on them, their abilities to adapt, their continued importance to the people of St. Vincent and the Grenadines as food, livelihoods and contribution to the economy; and
4. Research on the introduction of the most appropriate species to meet local needs and demands in the face of the adverse effects to be faced as a result of climate change and environmental pollution.

It is imperative that the above research areas focus on options, interactions ad synergies between global climate change and forest biodiversity.

5. Present and Future Networks

The Environmental Services Unit in the Ministry of Health and the Environment is responsible for coordinating the various biodiversity reports and is the focal point for the CBD; however, actual biodiversity management rests with a number of agencies. The major agencies are the Forestry Department and the Fisheries Division in the Ministry of Agriculture, Forestry and Fisheries. The Ministry of

Agriculture, Forestry and Fisheries as a larger entity also consists of other departments and units which have responsibilities relating to biodiversity management. These include the Plant Protection Unit, the Agriculture Department/Extension Tree Crops and Gardening Services, the Animal Health and Production Unit, and the Research and Development Unit.

Another important agency responsible for biodiversity related matters is the Central Planning Unit in the Ministry of Finance and Economic Planning. This agency deals with land use management and spatial mapping of natural resources. It is also responsible for ensuring the enforcement of legislation relating to Environmental Impact Assessments (EIA) and environmental mitigation. There is also the recently formed (2003) National Parks, Rivers and Beaches Authority which operates under the Ministry of Tourism and Culture as well as the Tobago Cays National Marine Park which is managed by a board.

There are also various private corporations and statutory organisations involved in certain aspects of biodiversity management. These include the electrical company, St. Vincent Electricity Services Ltd. (VINLEC) and the Central Water and Sewage Authority (CWSA).

Since there is no single agency concerned with biodiversity management, the coordination of management efforts is particularly challenging. It is important to note that while biodiversity issues are dealt with as part of the work programs of the above-mentioned agencies, biodiversity as a separate concern is not given adequate attention. Thus the various work programmes outlined in the decisions made by the Conference of Parties are generally not deliberately tackled, but instead tend to coincide with strategies being implemented by the various agencies.

One exception, however, is the Environmental Services Unit in the Ministry of Health and the Environment. The work programme of this unit centers on a number of key environmental issues and the implementation of various international conventions, multilateral environmental agreements (MEAs), and regional initiatives including those related to biodiversity.

In 1990, St. Vincent and the Grenadines adopted the Specially Protected Areas and Wildlife (SPAW) Protocol, which became international law in 2001. This protocol was designed to regionalize global conventions such as the Convention on Biological Diversity (CBD), the International Coral Reef Initiative (ICRI) and its action component, the International Coral Reef Action Network (ICRAN), and the Global Coral Reef Monitoring Network (GCMN). *See Attachment 3* for more information on the SPAW Protocol. In 2003, a demonstration project was launched

in St. Vincent and the Grenadines under the Caribbean Regional Environment Programme (CREP). The main objective of the project is "to enhance the contribution of natural areas of biodiversity and economic significance to the sustainable development of CARIFORUM[1] member states. The project is intended to help local people make a living while applying the principles of sustainable use. In 2001, St. Vincent and the Grenadines (SVG) signed the St. Georges Declaration of Principles for Environmental Sustainability in the Organisation of Eastern Caribbean States (OECS). This set of principles mandates actions specific to biodiversity conservation. *See Attachment 4* for detail.

At the 1994 Global Conference on the Sustainable Development of Small Island Developing States (SIDS) in Barbados, countries in the region, including St. Vincent and the Grenadines, adopted a Programme of Action for the Sustainable Development of SIDS, also known as the Barbados Programme of Action (BPOA). Chapter IX of this programme of action outlines a number of activities to be undertaken at the national level as it regards biodiversity conservation. These activities coincide with many of the articles in the CBD. *See Attachment 5* for more information.

Besides the various regional efforts, a number of local NGOs are involved in various biodiversity related projects. One outstanding NGO is the Bequia Sandwatch Group which is involved in the monitoring beach erosion, coral bleaching and other environmental hazards. Another group is the Mayreau Environmental Developmental Organisation (MEDO), based on the Grenadine Island of Mayreau, which collects and updates various checklists of biodiversity in St. Vincent and the Grenadines and which is involved in a number of conservation and sustainable use projects. This group is also engaged in a number of environmental education activities. In addition, the University of the West Indies Centre for Resources Management and Environmental Studies (CERMES) coordinated a project in the Grenadines that seeks to build the capacity of local communities to manage their biodiversity.

Acknowledgements

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ATTACHMENTS

Attachment 1

International Multilateral Environmental Agreements and National Legislations

The following agreements, singly or collectively, are supportive of adaptation measures for climate change which in turn make provisions for the conservation and protection of biological diversity and have all been signed by St. Vincent and the Grenadines:

- The ***United Nations Framework Convention on Climate Change (UNFCCC 1992):*** This convention and its protocol seek to control the emission of greenhouse gases. The Government of St. Vincent and the Grenadines and the private sector are taking measures to reduce greenhouse-gas emissions;
- The ***United Nations Convention on Biological Diversity (CBD 1992):*** This convention seeks to protect flora and fauna and their habitats from destruction by man. The Government of St. Vincent and the Grenadines has submitted three reports on biological diversity as part of this convention;
- The ***Basel Convention on the Control of Transboundary Movement of Hazardous Waste and their Disposal (1989):*** This Convention seeks to restrict the importation of hazardous waste;
- The ***Convention on Trade in Endangered Species (1989)*****:** The Convention attempts to regulate wildlife trade through worldwide system of import and export controls for species which are listed in three appendices. Appendix I of the Convention lists species which are threatened with extinction and for which commercial trade is prohibited; Appendix II lists species which may become extinct unless trade is strictly regulated; and Appendix III reports those species protected in their country for origin and for which the cooperation of other nations is required in order to enforce export restrictions;

- The ***Vienna Convention on the Protection of the Ozone Layer (1985):*** Protection of the ozone layer will reduce ultraviolet radiation. St. Vincent and the Grenadines has in place a programme to phase out the use of ozone-depleting substances under this convention;
- The ***United Nations Convention on the Law of the Sea (UNCLOS 1982):*** This convention prescribes jurisdictional rule for the protection of the marine environment. UNCLOS obligates coastal member states to "protect and preserve the marine environment". This convention provides the framework for the Exclusive Economic Zone;
- The ***International Convention for the Prevention of Pollution from Ships (MARPOL 1973):*** Enforcement of this convention will protect aspects of coastal resources against marine pollution;
- The ***Town and Country Planning Act (45 of 1992):*** This act makes provision to ensure orderly development of lands and the proper planning of town and country areas;
- The ***Forest Resource Conservation Act of 1992***, which makes provision for the management and protection of forested areas;
- The ***Fisheries Act of 1986***, which makes provision for the protection and management of fisheries and marine protected areas;
- The ***Beach Protection Act of 1981***, which makes provision for the control of sand mining and the general protection of beach areas; and
- The ***Central Water and Sewage Authority Act of 1992***, which permits the protection of water resources related to water-supply needs.

Attachment 2

Article 6 CBD: General Measures for Conservation and Sustainable Use

Each Contracting Party shall, in accordance with its particular conditions and capabilities:

(a) Develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes which shall reflect, inter alia, the measures set out in this Convention relevant to the Contracting Party concerned; and

(b) Integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.

Attachment 3

The Specially Protected Areas and Wildlife (SPAW) Protocol

(Adapted from the Caribbean Environment Programme (CEP) website **www.cep.unep.org**).

The Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (the Cartagena Convention) is the only legally binding environmental treaty for the Wider Caribbean. The Convention and its Protocols constitute a legal commitment by the participating governments to protect, develop and manage their common waters individually or jointly.

The SPAW Programme supports activities for the protection and management of sensitive and highly valuable natural marine resources. This Sub-Programme is responsible for the regionalization of global conventions and initiatives such as the Convention on Biological Diversity (CBD), the International Coral Reef Initiative (ICRI) and the Global Coral Reef Monitoring Network (GCRMN). A Memorandum of Cooperation exists between the CBD and UNEP-CAR/RCU to assist with the implementation of the CBD at the regional level.

The Protocol Concerning Specially Protected Areas and Wildlife (the SPAW Protocol) has been internationally recognized as the most comprehensive treaty of its kind. Adopted in Kingston, Jamaica by the member governments of the Caribbean Environment Programme on 18 January 1990, the SPAW Protocol preceded other international environmental agreements in utilizing an ecosystem approach to conservation. The Protocol acts as a vehicle to assist with regional implementation of the broader and more demanding global Convention on Biological Diversity (CBD).

The objectives of SPAW are:

- To significantly increase the number of and improve the management of national protected areas and species in the region, including the development of biosphere reserves, where appropriate.
- To develop a strong regional capability for the co-ordination of information exchange, training and technical assistance in support of national biodiversity conservation efforts.
- To coordinate activities with the Secretariat of the Convention on Biological Diversity, as well as other biodiversity-related treaties, such as the CITES, Ramsar, Bonn and Western Hemisphere Conventions.
- To assist the Governments of the region, upon their request, in the development of guidelines regarding the application of regulations and

economic steering instruments in the decision-making process toward the establishment and enforcement of measures necessary to prevent, reduce and control marine pollution and to provide them with the relevant information.

Advantages:

1. The only regional environmental legal agreement addressing biodiversity conservation issues of the Wider Caribbean.
2. Its provisions provide specific and concrete guidance for the implementation of the Convention on Biological Diversity (CBD), in particular regarding protected area establishment and management, as well as species and coastal ecosystems management and conservation. (The CBD is very demanding on those issues but does not provide guidance which SPAW does).
3. SPAW was developed *by* the governments of the region and *for* the region. In this way is more appropriate and specific to the Wider Caribbean than other global treaties.
4. It is supported by an operational programme, which is currently supporting for example: marine protected areas in the region, countries with coral reef conservation and management, countries in implementing sustainable tourism practices, etc.
5. It has no direct financial implications for the countries as the Trust Fund is independent from the Convention (Dominica has been paying to the Trust Fund anyway and they are not fully benefiting from SPAW as they have not become Parties).
6. Being a Party to SPAW sends a clear message to the region and donors about the commitment of a country (Dominica) towards biodiversity conservation. This could particularly relevant a Dominica develops as a "Green Globe" destination.
7. SPAW provides for the establishment of a Scientific and Technical Advisory Committee (STAC) to address issues and identify priorities. The STAC could be used by the region to address CBD issues and form consensus. The participation of the region in CBD meetings has been very poor and the STAC could be used as a mechanism to carry a unified voice from the region to CBD.
8. A Party to SPAW will benefit from the activities of the SPAW Programme and from regional cooperation opportunities in the management of coastal and marine resources.
9. A Party to SPAW will also benefit from the Memorandum of Cooperation which exists between CBD and SPAW Secretariats.
10. A Party to SPAW will benefit from technical assistance from the SPAW Regional Activity Centre to be established in 1999 in the National park of Guadeloupe.

Attachment 4

The OECS Environmental Management Strategy & the St. Georges Declaration of Principles for Environmental Sustainability in the OECS

(Adapted from the Development Gateway website)
http://topics.developmentgateway.org/oecsaid/rc/filedownload.do~itemId=270681
http://topics.developmentgateway.org/oecsaid/rc/filedownload.do~itemId=270681.

THE OECS ENVIRONMENTAL MANAGEMENT STRATEGY

"To protect, conserve and enhance or restore, where appropriate, the quality and value of the region's natural resources in order to sustain social and economic development for present and future generations."

Vision Statement to guide implementation of
The St George's Declaration Of Principles For
Environmental Sustainability In The OECS

At the Third Meeting of the Organisation of Eastern Caribbean States (OECS) Environment Policy Committee (September 1999) OECS Ministers of The Environment requested that the OECS Natural Resources Management Unit (NRMU) prepare an "OECS Charter for Environmental Management" and "a regional strategy...that will become the framework for environmental management" in the region. In accordance with the Ministers' request, OECS NRMU developed the *St. George's Declaration Of Principles For Environmental Sustainability In The OECS*, which was signed by Ministers in April 2001 and which sets out the broad framework to be pursued for environmental management in the OECS region.

The *St. George's Declaration of Principles for Environmental Sustainability in the OECS* comprises twenty one principles. They are:

Principle 1 **Foster Improvement in the Quality of Life**

Principle 2 **Integrate Social, Economic and Environmental Considerations into National Development Policies, Plans and Programmes**

Principle 3 **Improve on Legal and Institutional Frameworks**

Principle 4 **Ensure Meaningful Participation by Civil Society in Decision Making**

Principle 5	**Ensure Meaningful Participation By The Private Sector**
Principle 6	**Use Economic Instruments for Sustainable Environmental Management**
Principle 7	**Foster Broad-based Environmental Education, Training and Awareness**
Principle 8	**Address the Causes and Impacts of Climate Change**
Principle 9	**Prevent and Manage the Causes and Impacts of Disaster**
Principle 10	**Prevent and Control Pollution and Manage Waste**
Principle 11	**Ensure the Sustainable Use of Natural Resources**
Principle 12	**Protect Cultural and Natural Heritage**
Principle 13	**Protect and Conserve Biological Diversity**
Principle 14	**Recognise Relationships between Trade and Environment**
Principle 15	**Promote Cooperation in Science and Technology**
Principle 16	**Manage and Conserve Energy**
Principle 17	**Negotiate and Implement Multi-lateral Environmental Agreements**
Principle 18	**Coordinate Assistance from the International Community towards the Organisation of Eastern Caribbean States**
Principle 19	**Implementation and Monitoring**
Principle 20	**Obligations of Member States**
Principle 21	**Review**

Following is a description of some of the principles of the *St. George's Declaration for Environmental Sustainability in the OECS* that complement various elements of the Convention on Biodiversity (CBD).

PRINCIPLE 11

Ensure the Sustainable Use of Natural Resources

Each Member State agrees to:

(a) Manage terrestrial, marine and atmospheric resources, organisms and eco-systems in an appropriate manner to obtain the optimum sustainable productivity, while maintaining the integrity of natural and ecological processes and inter-relationships between such systems and processes;
(b) Design, promote and implement measures to prevent, mitigate and control degradation of aquatic, terrestrial and atmospheric environmental quality and processes conducive to desertification;
(c) Cooperate in the conservation, management and restoration of natural resources existing in areas under the jurisdiction of more than one State, or which may exist in areas that are fully or partially beyond the limits of its national jurisdiction;
(d) Work together, in collaboration with Civil Society, to promote and facilitate improved national and regional capability for the management of natural resources;
(e) Collaborate in the implementation of appropriate precautionary approaches aimed at managing and avoiding environmental degradation and over-exploitation of natural resources within the sub-region;
(f) Take all necessary measures within its legal and policy framework, including enactment of new legislation where appropriate, to ensure that conservation and management of natural resources are treated as an integral part of development planning at all stages and levels;
(g) Develop a schedule of development activities for which environmental impact assessment will be required as part of project definition and design, and the results of which will be considered in determining whether and how a project will proceed.

PRINCIPLE 13

Protect and Conserve Biological Diversity

Each Member State agrees to:

(a) Pursue appropriate measures to conserve and, where necessary, restore biological diversity, including species diversity, genetic diversity within species and ecosystem diversity;
(b) Manage biological resources to ensure their conservation, sustainable use and possible restoration;
(c) Establish appropriate legal and institutional structures to control and licence the prospecting for, or harvesting and export of cultural and ecological resources;
(d) Take necessary precautionary measures to avoid or minimize, the intentional or accidental introduction or escape, into or from the environment, of alien or modified organisms that are likely to impact adversely on other organisms or the environment;
(e) Take appropriate measures to control or eradicate alien or modified organisms having the potential to impact adversely on other organisms the environment or human health;
(f) Take appropriate measures to ensure that activities within its jurisdiction, do not damage the biological diversity and the environment of another State, within or beyond the limits of that other State's national jurisdiction.
(a) Assess and where appropriate, adopt new technologies, techniques and methodologies for achieving effective environmental management.

PRINCIPLE 15

Promote Cooperation in Science and Technology

Each Member State agrees to:

(b) Promote directly or through competent regional or other international agencies cooperation in the fields of science, technology and other research in support of sound and sustainable natural resource and environmental management , and the sustainable development of human resources;
(c) Promote scientific and technical cooperation in the field of environmental conservation and the sustainable use of natural resources;

(d) Cooperate to establish, adopt and implement comparable or standardized research techniques and harmonized methods to measure environmental parameters, and promoting widespread and effective participation of all States in establishing such methodologies;
(e) Assess and where appropriate, adopt new technologies, techniques and methodologies for achieving effective environmental management.

PRINCIPLE 17

Negotiate and Implement Multi-lateral Environmental Agreements

Each Member State agrees to:

(a) Endeavour to become and remain parties to multi-lateral environmental agreements relating to the subject-matter of this Declaration;
(b) Collaborate to establish or better utilise existing sub-regional negotiating mechanisms for multi-lateral environmental agreements;
(c) Cooperate to the degree feasible in formulating common positions in the negotiation and implementation of multi-lateral environmental agreements;
(d) Establish appropriate mechanisms to facilitate the exchange of information relating to the negotiation, implementation and compliance with multi-lateral environmental agreements;
(e) Ensure, to the extent feasible, that the Principles contained in this Declaration are fully integrated into the negotiation and implementation of multi-lateral environmental agreements;
(f) Reserve the right of Member States, whether individually or together, to adopt and implement measures, where necessary, beyond the provisions of multi-lateral agreements for the purpose of meeting the needs of this Declaration while maintaining compliance with the multi-lateral agreements to which they are signatories.

PRINCIPLE 19

Implementation and Monitoring

Each Member State agrees to:

(a) Ensure that all new national policies and programs are undertaken in a manner that is consistent with the principles contained in the Declaration;
(b) Cooperate in good faith with each other to achieve optimal results from their environmental policies and actions relating to the use of trans-boundary natural resources, and in the effective prevention or abatement of trans-boundary environmental problems;
(c) Work concertedly together to implement the Principles enunciated in this Declaration;
(d) Implement the commitments contained in Annex A to this agreement in a timely and expeditious manner, and with all due diligence, and report periodically on measures undertaken to satisfy this requirement;
(e) Work concertedly together to develop the OECS Environmental Management Strategy that will give effect to this Declaration;
(f) Undertake to apply minimum acceptable standards at all times in respect of addressing issues concerning the impact or adverse effects of trans-boundary natural resources on the environment;
(g) Develop a national environmental management strategy within two (2) years of the date this Declaration comes into force;
(h) Designate an entity comprised of each Member State to monitor and facilitate the compliance of each Member State with this Declaration, and to report on measures undertaken to implement this Agreement;
(i) Communicate timely and relevant information on all aspects of the St George's Declaration's Principles to other interested States.

Attachment 5

Programme of Action for the Sustainable Development of Small Island Developing States

(Selected Passage)

Adapted from the United Nations Department of Economic and Social Affairs website, from the Report of the Global Conference on the Sustainable Development of Small Island Developing States (Bridgetown, Barbados, 25 April-6 May 1994).

Full text available at **www.un.org/documents/ga/conf167/aconf167-9.htm**.

IX. BIODIVERSITY RESOURCES

Basis for action

41. Small island developing States are renowned for their species diversity and endemism. However, due to the small size, isolation and fragility of island ecosystems, their biological diversity is among the most threatened in the world. Deforestation, coral reef deterioration, habitat degradation and loss, and the introduction of certain non-indigenous species are the most significant causes of the loss of biodiversity in Small Island developing States.
42. In the past, there has been a strong emphasis on the collection of more information. In small island developing States where limited and biologically precious resources are being threatened, while the lack of sufficient information is often cited as a rationale for inaction, there is often enough information to identify areas requiring in situ conservation. Although more information will be required in order to develop appropriate management plans, information collection should no longer be a prior condition for in situ conservation projects.
43. The nature of traditional, often communal land and marine resource ownership in many island countries requires community support for the conservation effort. Without that local support and commitment and the opportunity to integrate sustainable income generation into the conservation effort, even the most highly studied and well planned conservation area will not be sustainable.

44. Some of the most precious biological resources for islanders, environmentally, economically and culturally, are marine and coastal rather than terrestrial. This requires a conservation focus that takes into account customary land and reef tenure systems and practices, which may differ from that usually found in the larger developed countries. Other considerations include the adequacy of basic institutional support for conservation efforts (staff, vehicles etc.) and access to financial resources to help start innovative projects.
45. A number of international and regional conventions exist concerning the conservation and sustainable utilization of biological resources, which are expected to provide a sound legal framework of potential benefit to the sustainable development of small island developing States.

A. National action, policies and measures

(i) Formulate and implement integrated strategies for the conservation and sustainable use of terrestrial and marine biodiversity, in particular endemic species, including protection from the introduction of certain non-indigenous species and the identification of sites of high biological significance for the conservation of biological diversity and/or for eco-tourism and other sustainable development opportunities, such as sustainable agriculture, training and research.

(ii) Ratify and implement the Convention on Biological Diversity, 10/ the Convention on International Trade in Endangered Species of Wild Fauna and Flora 11/ and other relevant international and regional conventions.

(iii) Promote community support for the conservation of biological diversity and the designation of protected areas by concentrating on educational strategies that increase awareness of the significance of biodiversity conservation, in particular the fundamental importance to resource-owning communities of a diverse biological resource base.

(iv) Generate and maintain buffer stocks or gene banks of biogenetic resources for reintroduction into their natural habitat, especially in the case of post-disaster restoration and rehabilitation.

(v) Develop or continue studies and research on biological resources, their management and their intrinsic socio-economic and cultural value, including biotechnology.

(vi) Conduct detailed inventories of existing flora, fauna and ecosystems to provide basic data needed for the preservation of biodiversity.

(vii) Ensure that the ownership of intellectual property rights is adequately and effectively protected. Ensure, subject to national legislation and policies, that the technology, knowledge, and customary and traditional practices of local and indigenous people, including resource owners and custodians, are

adequately and effectively protected, and that they thereby benefit directly, on an equitable basis and on mutually agreed terms, from any utilization of such technologies, knowledge and practices, or from any technological development directly derived therefrom.

(viii) Support the involvement of non-governmental organizations, women, indigenous people and other major groups, as well as fishing communities and farmers, in the conservation and sustainable use of biodiversity and biotechnology.

B. Regional action

(i) Encourage countries to give priority to known, existing sites of biological significance - while recognizing that there are many important sites whose biological significance remains unknown and to build up community support for the protection of those areas including their protection from the introduction of non-indigenous species.

(ii) Promote regional studies of the socio-economic and cultural value of biological resources, including genetic engineering, intellectual property rights and access to biotechnology, with the participation of existing or strengthened scientific institutions, relevant international agencies and non-governmental organizations.

(iii) Promote the establishment of regional gene-bank centres for research, seeking the development and introduction of more resistant and productive varieties of species, and provide the appropriate legal and technical procedures for the use of those biological resources.

(iv) Coordinate information exchange, training and technical assistance in support of national efforts to establish and manage conservation areas and for species conservation, including the identification and use of traditional knowledge and techniques for resource management that assist the conservation of biological resources and diversity.

(v) Promote and/or strengthen already existing regional scientific institutions that can operate as reference centres for problems related to the conservation and sustainable management of biodiversity.

(vi) Strengthen the capacity of regional organizations to provide technical support and coordination in the development of inventories of flora, fauna and ecosystems and, where feasible, to establish regional databases and gene banks.

(vii) Support the development of adequate and effective legal mechanisms for the protection of intellectual property rights.

C. International action

(i) Provide improved access to financial and technical resources for the conservation of biological diversity, including funds for basic institutional and logistic support for the conservation and management of biological diversity, with priority to be accorded to terrestrial as well as coastal and marine biodiversity, such as coral reef ecosystems.

(ii) Improve access to environmentally sound biotechnology, including know-how and delivery mechanisms.

(iii) Ensure that the activities of relevant international organizations, agencies and programmes of the United Nations as well as relevant non-governmental organizations are closely coordinated with and supportive of identified regional small island developing States centres or ongoing programmes in the conservation and sustainable use of biodiversity and biotechnology.

(iv) Make greater use of import restrictions under the Convention on International Trade in Endangered Species of Wild Fauna and Flora on products from endangered species endemic to small island developing States.

(v) Support national and regional actions for developing inventories of flora, fauna and ecosystems, including training and technical assistance.

(vi) Support strategies to protect small island developing States from the introduction of non-indigenous species.

(vii) Promote the full involvement of non-governmental organizations, women, indigenous people and other major groups, as well as fishing communities and farmers, in the conservation and sustainable use of biodiversity and biotechnology.