PLANNING INSTITUTE OF JAMAICA

Review of Policy, Plans, Legislation and Regulations for Climate Resilience in Jamaica

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List of Abbreviations and Acronyms

AGD	=	Attorney General Department
AGLUP	=	Agricultural Land Use Policy
CARICOM	=	Caribbean Community
CCCCC	=	Caribbean Community Climate Change Centre
CPACC	=	Caribbean Planning for Adaptation to Climate Change
CRED	=	Centre for Epidemiological Research on Disasters
EIA	=	Environmental Impact Assessment
EEZ	=	Exclusive Economic Zone
EMS	=	Environmental management system
EOE	=	Energy Conservation and Efficiency Protocol
ENSO	=	El Nino Southern Oscillation
FAO	=	Food and Agriculture Organization
FD	=	Forestry Division
FME	=	Free Market Environmentalism
GCM	=	General Circulation Models
GEF	=	Global Environmental Fund
GHG	=	Greenhouse Gas
GoJ	=	Government of Jamaica
ICTSD	=	International Centre for Trade and Sustainable Development
ICZM	=	Integrated Coastal Zone Management
IPCC	=	Intergovernmental Panel on Climate Change
JIE	=	Jamaica Institute of Engineers
JNCCPA	=	Jamaica National Climate Change Policy and Action Plan
JSNC	=	Jamaica's Second National Communication to the UNFCCC
KMA	=	Kingston Metropolitan Area
LDU	=	Land Development and Utilisation
LDUC	=	Land Development and Utilisation Commission
MACC	=	Mainstreaming Adaptation to Climate Change
Met. Service	=	National Meteorological Service
MoAF	=	Ministry of Agriculture and Fisheries
MoW&H	=	Ministry of Water & Housing
NEPA	=	National Environment and Planning Agency
NFMCP	=	National Forest Management and Conservation Plan
NIC	=	National Irrigation Commission
NIDP	=	National Irrigation Development Plan
NWC	=	National Water Commission
ODPEM	=	Office of Disaster Preparedness and Emergency Management
OPM	=	Office of the Prime Minister
OUR	=	Office of Utilities Regulation
PAHO	=	Pan American Health Organisation
PCs	=	Parish Councils
PIOJ	=	Planning Institute of Jamaica

PRECIS	=	Providing Regional Climates for Impact Studies
SIDS	=	Small Island Developing States
SDSM	=	Statistical Down Scaling Model
SFMP	=	Strategic Forest Management Plan
SRES	=	Special Report on Emissions Scenarios
UNCED	=	United Nations Conference on Environment and Development
UNDP	=	United Nations Development Programme
UNEP	=	United Nations Environment Programme
UNFCCC	=	United Nations Framework Convention on Climate Change
UNGA	=	United Nations General Assembly
UNWTO	=	United Nations World Tourism Organisation
UWI	=	University of the West Indies
WHO	=	World Health Organisation
WRA	=	Water Resources Authority

1 EXECUTIVE SUMMARY

1.1 Introduction

There is increasing evidence of human interference in the climate change system which has led to global warming. With the concern over global environmental issues, the United Nations General Assembly (UNGA) ADOPTED RESOLUTION 43/53 on the protection of the global climate for present and future generations. The UNGA in a subsequent resolution provided the basis for the negotiations of a framework convention on climate change. Final negotiations with regards to the United Nations Framework Convention on Climate Change (UNFCCC) occurred at the United Nations Conference on Environment and Development (UNCED), Rio de Janeiro, Brazil, with the UNFCCC becoming open for signature on 4th June 1992. Jamaica signed on to the United Nations Framework Convention on Climate Change (UNFCCC) on September 6, 1996.

Compelling evidence indicates that global climate has changed compared to the pre-industrial era and is anticipated to continue to change over the 21st century and beyond. The Intergovernmental Panel on Climate Change (IPCC) declared that "*warming of the climate system is unequivocal.*" Since climate change appears to be inevitable and Small Island Developing States (SIDS) such as Jamaica are particularly vulnerable due in part to the close proximity to the coasts of major cities and towns; our latitudinal location in the Caribbean; our geology and topography; and anthropogenic activities, it is important that Jamaica mainstream climate change and develop mitigation[1], adaptation[2] and resilience strategies to preserve/protect our human, environmental, cultural and economic resources.

In addition, as a party to the UNFCCC, Jamaica is subject to a number of commitments, which places obligations on Jamaica to respond to climate change. Jamaica has taken several initiatives to mainstream climate change into its national developmental processes and mechanisms, chief among these is the Vision 2030 National Development Plan which has climate change incorporated as one of its 15 outcomes. Jamaica has prepared and submitted to the UNFCCC two national communications, and has prepared a national inventory of anthropogenic emissions by sources and removals by sinks of all GHG not controlled by the Montreal Protocol.

[1] Mitigation is defined by the IPCC as, "Technological Technological change and substitution that that reduce resource inputs and emissions per unit of output. … with respect to Climate Change, mitigation means implementing policies to reduce greenhouse gas emissions and enhance sinks."
[2] Adaptation is defined by the IPCC as, "Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects."

Jamaica has participated in regional climate change projects such as the Caribbean Planning for Adaptation to Climate Change (CPACC) 1997-2001; Adaptation to Climate Change in the Caribbean (ACCC) 2001-2004; and Mainstreaming Adaptation to Climate Change (MACC) 2004-2009. These projects have helped to understand the region's vulnerabilities to climate change, to build capacity to address climate change at the national level, engage in adaptation, support mainstreaming of adaptation into policy processes, and begin implementation of adaptation measures. Jamaica is currently participating in the Climate Change Adaptation and Disaster Risk Reduction project and the main objective of this project is to assist Jamaica with its adaptation to climate change and to contribute to sustainable development.

Climate change in the Jamaican context will most likely result in extremes in climate such as heat waves, heavy precipitation, and an increase in the incidence of intense storms and hurricanes as a result of increases in tropical sea surface temperatures. Sea level rise will cause increased coastal erosion, flooding, and salt water intrusion into fresh water aquifers. Changes in weather patterns will affect water supply and this, along with increased temperatures and salt water intrusion will have negative effects on agriculture in particular.

The majority of Jamaica's population lives in coastal areas and consequently, coastal hazards have a significant impact on the social and economic wellbeing of the country. Assessments of Jamaica's vulnerability to climate change reveal that vulnerable sectors include *inter-alia*:

- Agriculture
- Coastal Zone
- Critical Infrastructure
- Energy
- Fisheries
- Health
- Tourism
- Land Use
- Water

Most areas of Jamaica will begin to show decreases in precipitation by the 2050s and 2080s, and the drying effect will become significant by the 2080s when it is projected to decrease by as much as 40% for some areas. Although there will be an overall drying effect, there will be periods of intense rainfall which will result in flooding.

Therefore the hydrometric network needs to be improved and rationalized; additional flood warning systems installed; and software such as riverware procured; and more automatic weather stations procured to aid in data collection and planning.

Temperature is likely to increase in Jamaica by approximately 1.5^{o} C by the 2080s under the A1B scenario. However, the increase in temperature will depend on future emissions. To help limit temperature increase to less than 2^{o} C this century, many scientists and international organisations are advocating significant cutbacks in greenhouse gases, and many European Union countries have committed to drastic reductions.

As a result of predicted global warming, sea level is expected to rise by 0.21 to 0.48 m under an A1B scenario by the end of the century, and this will result in, for example, inundation of low lying coastal areas, and inward retreat of estuaries. Due to the vulnerability of our coastal zone, it is imperative that the tidal gauge network should be reinstated; mangrove replanting should be a priority; and data collection needs to be improved along with an improvement in the current geographic information systems to assist with planning and project design.

Coral reefs are an integral part of the island's ecosystem and they are vulnerable to increases in sea water temperature which results in coral bleaching. Bleaching of coral reefs adversely affects reef fauna and increases the vulnerability of the coasts to erosion.

Aspects of climate change such as sea level rise, flooding, greenhouse gas emissions have led to emerging issues such as carbon trading (see section 2.8.2).

Some institutions in Jamaica which will be part of climate change planning, mainstreaming, adaptation and resilience are:

- The Forestry Department
- Ministry of Agriculture and Fisheries (MoAF)
- National Environment and Planning Agency (NEPA)
- National Irrigation Commission (NIC)
- National Meteorological Service
- National Water Commission (NWC)
- Office of Disaster Preparedness and Emergency Management (ODPEM)
- Water Resources Authority (WRA)

Appendix 1 gives the Strategy and Plan of Action to improve Technical and Institutional Capacity, Plans, Policies and Legislation needed to adequately deal with climate change.

1.2 Key Sectors and Associated Legislation and Regulations, Policies and Plans

Key Areas/sectors are Agriculture, Food Security, the Coastal Zone, Disaster Resilience, Education, Fisheries, Forestry, Health, Housing and Human Settlements, Tourism, and Water. Legislation and regulations, policies and plans for these areas/sectors were reviewed (see table below), and where applicable, a comparison made between these and recommendations made in the Second National Communication to the UNFCCC.

Policies/Guidelines	Plans	Legislation and Regulations
Agricultural Land Use Policy	Vision 2030 Jamaica: National Development Plan	Natural Resource Conservation Authority Act
Draft Plant Health Policy	Jamaica National Environment Action Plan	Natural Resources Conservation (Blue and John Crow Mountains National Park) (Declaration) Order (1993) and the Natural Resources National Parks Regulations
Organic Policy	National Strategy and Action Plan on Biological Diversity	Natural Resources (Blue and John Crow Mountains National Park) (User Fees) Regulations (2003)
Draft Food and Nutrition Security Policy	National Forest Management and Conservation Plan	Natural Resources (Montego Bay Marine Park Order (1992) and Natural Resources (Marine Parks) Regulations (1992)
Jamaica National Energy Policy	Strategic Forest Management Plan	Natural Resources Conservation Authority (Air Quality) Regulations, 2006
National Renewable Energy Policy 2009 – 2030 …Creating a Sustainable Future	Draft National Spatial Plan	Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and

Policies/Guidelines	Plans	Legislation and Regulations
		Development) Order, 1995 and the Natural Resources (Permits and Licenses Regulations)
Draft Carbon Emissions Trading Policy	Master Plan for Sustainable Tourism Development	Natural Resources Conservation (Portland Bight Protected Area) Regulations 2000 (Draft)
National Transport Policy	NEPA Climate Change Response Strategy 2010-2015	Beach Control Act, 1956
Integrated Solid Waste Management Policy		Port Authority Act (1972)
Policy on Environmental Stewardship of Government Operations		The Morant and Pedro Cays Act (1904)
Draft Strategic Environmental Assessment Policy		The Harbours Act (1976)
Ocean and Coastal Zone Management Policy		The Maritime Areas Act
Mangrove and Coastal Wetlands Protection – Draft Policy and Regulations		The Fishing Industry Act, 1975. Draft Fisheries Bill
National Policy for the Conservation of Seagrasses		The Forest Act, 1996
Towards a Beach Policy for Jamaica (A Policy for the Use of the Foreshore and the Floor of the Sea) November 2000 (Draft)		Forest Regulations, 2001
Coral Reef Protection and Preservation Policy		Endangered Species (Protection, Conservation and Regulation of Trade) Act, 2000
Draft Mariculture Policy		The Office of Disaster Preparedness and Emergency Management Act (1998)
Draft Fisheries Policy		Disaster Management

Policies/Guidelines	Plans	Legislation and Regulations
		Act 2009 (Draft)
Forestry Policy		Town and Country Planning Act, 1957 (Amended in 1999)
National Land Policy		The Town and Country Planning Coast Confirmed Development Orders
Policy for Jamaica's System of Protected Areas		Land Development and Utilisation Act (1966)
Jamaica Water Sector Policy, Strategies and Action Plan		Parish Councils Building Act
Towards a Watershed Policy for Jamaica		Local Improvements Act (1914)
The National Hazard Mitigation Policy and National Response Matrix		The Housing Act (1969)
NRCA Guidelines for Deployment of Benthic Structures		The Land Authority Act (1951)
NRCA Guidelines for Environmental Impact Assessment		National Heritage Trust Act (1985)
NRCA Guidelines Pertaining to Marinas and Small Craft Harbours		The Tourist Board Act (1955)
NRCA Guidelines for the Planning, Construction and Maintenance of Facilities for Enhancement and Protection of Shorelines		Water Resources Authority Act, 1995
Draft Jamaica National Climate Change Policy and Action Plan		Watershed Protection Act, 1965

The first policy that will have to be finalised and implemented is the Jamaica National Climate Change Policy and Action Plan. Plans, policies, guidelines, legislation and regulations which will need to be amended/updated/created/implemented to incorporate climate change are (see Appendix 2 for more details):

Policies/Guidelines	Plans	Legislation and Regulations
Draft Plant Health Policy	National Forest Management and Conservation Plan	The Fishing Industry Act, 1975; Fisheries Bill
Draft Mariculture Policy	Strategic Forest Management Plan	Beach Control Act, 1956
Draft Fisheries Policy	Jamaica National Environmental Action Plan	The Office of Disaster Preparedness and Emergency Management Act (1998)
Organic Policy	Master Plan for Sustainable Tourism Development	Regulations of the Natural Resources Conservation (Portland Bight Protected Area) Regulations 2000 (Draft)
Forest Policy	National Spatial Plan	Natural Resource Conservation Authority Act
National Policy for the Conservation of Seagrasses		Natural Resources Conservation Authority (Air Quality) Regulations, 2006
Towards a Beach Policy for Jamaica A policy for the Use of the Foreshore and the Floor of the Sea) November 2000 (Draft);		The Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order, 1996 and The Natural Resources (Permits and Licenses Regulations)
Ocean and Coastal Zone Management Policy		Town and Country Planning Act, 1957 (Amended in 1999)
NRCA Guidelines Pertaining to Marinas and Small Craft Harbors		The Town and Country Planning Coast Confirmed Development Orders
NRCA Guidelines for the Planning, Construction and Maintenance of Facilities for Enhancement and Protection of Shorelines		Land Development and Utilisation Act (1966)

Policies/Guidelines	Plans	Legislation and Regulations
NRCA Guidelines for Development in the Coastal Zone in Jamaica (1998)		Local Improvements Act (1914)
NRCA Guidelines for the Deployment of Benthic Structures		The Housing Act (1969)
NRCA Guidelines for Development in the Coastal Zone in Jamaica (1998)		Watershed Protection Act, 1965
NRCA Guidelines for Environmental Impact Assessment (1998)		Urban Development Corporation Act
Jamaica National Transport Policy		Development Orders and Plans
Integrated Solid Waste Management Policy		Water Resources (Amendment) Act
Policy on Environmental Stewardship of Government Operations		New Environmental Management Act
National Health Policy 2005 - 2015		New Meteorological Act
Jamaica Water Sector Policy, Strategies and Action Plan		Renewable Energy Act
Towards a Watershed Policy for Jamaica		

Plans, policies, legislation and regulations which incorporate climate change and need to be finalised/implemented are:

- Jamaica National Climate Change Policy and Action Plan
- Agricultural Land Use Policy
- Draft Food Nutrition Security Policy;
- Draft Fisheries Bill
- Draft Carbon Emissions Trading Policy
- Disaster Management Act 2009 (Draft)
- National Renewable Energy Policy 2009 – 2030 …Creating a Sustainable Future (Draft)

Climate change has to be mainstreamed in existing legislation, e.g. the NRCA Act and consideration should be given to domesticating UNFCCC and the Kyoto Protocol.

1.3 Major National Initiatives

The 2009 Vision 2030 Jamaica National Development Plan establishes a blueprint for future development and it provides the overarching context within which Jamaica's mitigation activities will take place. Mitigation will be addressed through greater energy conservation. Adaptation is treated in the sector plan for Natural Resources and Environmental Management and Climate Change because of its many effects on natural resources. Sector plans for Poverty Reduction, Agriculture, Tourism and Natural Resources and Environmental Management and Hazard Risk Reduction and Climate Change were reviewed.

1.4 Other Key Policies, Plans, Guidelines and Legislation

There are a wide range of policies that need to be reviewed in the context of mainstreaming climate change. Climate change data should be used in the current review of policies and plans, and all policies should be reviewed against the background of emerging climate change data, but definitely every three years.

1.5 Comparative Developments

Jamaica is a party to the UNFCCC and the Kyoto Protocol. However, no legislation has yet been enacted in Jamaica to mainstream climate change. Comparative Policy developments within the CARICOM area for Belize and St. Lucia were reviewed. It Legislative models in other countries that have sought to enact legislative provisions to implement the UNFCCC and the Kyoto Protocol were reviewed.

At present no CARICOM country has enacted legislation to domesticate the UNFCCC or to mainstream climate change. However, Dominica has draft legislation to enact

an Environment and Climate Change Act. This draft Act will set up an Environment and Climate Change Department and give legal effect to a number of multilateral environmental agreements including the UNFCCC and the Kyoto Protocol.

Caribbean Developments - Policy

Belize's Climate Change Adaptation Policy encourages all agencies in Belize to explore and access the opportunities being developed by the climate change negotiation process such as capacity building, new sources of funding, and technology transfer. It also mandates the relevant government agencies to prepare adaptation policy options for their sectors.

The aim of Saint Lucia's National Climate Change Adaptation Policy is to foster and guide a national process of addressing the short, medium and long term effects of climate change in a coordinated, holistic and participatory manner in order to ensure that, to the greatest extent possible, the quality of life of the people of St. Lucia, and opportunities for sustainable development are not compromised.

Developments Outside of the Caribbean Area - Legislation

Countries such as Australia, the UK, Mexico, and New Zealand have established legislation to *inter alia* reduce greenhouse gas (GHG) emissions (mitigation). Whereas the legislation in the Philippines, Nigeria, and South Africa deals with mainstreaming climate change adaptation measures in policies and plans and in strengthening the institutional framework for the management of climate change. Several other countries have mainstreamed mitigation and adaptation responses into existing laws or by formulating new laws.

The UK's revised Energy Act and a Climate Change Act (2008), makes the government's commitment to reduce carbon emissions by 80% by 2050 a legal requirement, binding future governments. The Climate Change Act paves the way for introduction of an emissions trading scheme. The Energy Act provides for feed-in tariffs, a renewable heat incentive, increased weight to be given to sustainable development, and other measures.

In April 2012, Mexico[3] passed climate change legislation which (similarly to the UK) has legally binding emission goals aimed at stemming the effects of climate change. The new law includes a mandate to reduce carbon dioxide emissions by 30% below business as usual levels by 2020, and by 50% below 2000 levels by 2050. In addition, it stipulates that 35% of the country's electricity supply should come from renewables by 2024. The act establishes a commission to oversee implementation and development of a carbon-trading scheme.

[3] Nature. "Mexico passes climate-change law" http://www.nature.com/news/mexico-passes-climate-change-law-1.10496

In Nigeria a Bill to establish a Climate Change Commission has been passed by both Houses of the National Assembly and now awaits presidential assent.

South Africa is moving towards the introduction of Climate Change legislation. The proposed legislation would set emission reduction outcomes for each significant sector in the economy.

1.6 Assessment of Information Gaps

Some gaps in plans, policies and legislation are:

Development Orders
The current Development Orders do not deal adequately with climate change considerations, and the planning legislation guiding development is outdated. Some problems related to the planning framework include human resources and financial constraints, the gap between planning and environmental management has not been bridged, the planning system is supported by reactive initiatives.

Protection of Ecological Buffers
Regulations governing the use of wetlands and mangroves need to be strengthened to ensure that ecological buffers are protected as a priority. Filling of wetlands, damming of rivers, mining coral and beach sands, cutting of mangroves should be prohibited to preserve the natural storm abatement function of these areas.

Develop Comprehensive Land-use Plans
Comprehensive land-use plans that account for high hazard areas and climate risks must be developed to reduce island vulnerability. These plans need to be integrated throughout several government agencies and developed through consultative processes.

Develop and Implement Integrated Coastal Management Plans
Integrated Coastal management should be a priority for government agencies charged with land-use planning and natural resource management. National and local level management plans to conserve these ecosystems should be a top priority for adaptation since coastal ecosystems act as buffers to the impacts of climate variability.

Develop Coordinating Mechanisms to Ensure that Watershed Management Plans are Implemented at Both the Ministerial and Private Sector Levels
Many land use decisions in watersheds are not coordinated; as a result, land use practices are often a large source of sedimentation in coastal waters that limits the

capacity of the coastal ecosystems to buffer storm surge and inundation. Government agencies should be encouraged to work with various stakeholders in individual watersheds to plan uses that protect riparian forests and agricultural areas to reduce or control sediment loads to coastal waters.

Employ a Retreat Approach to Planning and Development in High Hazard Areas Along the Coastline

Land-use planning should encourage a strategic retreat from development and infrastructures in low-lying coastal floodplains and high hazard areas; planning and development would be based on retreat plans, where new structures are located on setback lines behind these areas.

Integrate Regional Disaster Mitigation Strategies with National/Physical Planning

Historically development of physical and disaster mitigation plans has been done separately under different ministries with little or no integration. Coordination of functions will facilitate improvements in planning and development by taking into consideration the need for improved building codes to reduce the loss of life and property; discouragement of development in high hazard areas, incorporation of a retreat policy and promotion of the use of soft structures to control erosion and flooding.

NEPA Climate Change Response Strategy

The NEPA Climate Change Response Strategy 2010-2015 if fully implemented would effectively mainstream climate change considerations for the main policies and plans falling within the responsibility of NEPA.

Tourism Master Plan

The Tourism Master Plan did not provide for climate change or disaster planning. These deficiencies were addressed by the Vision 2030 Tourism Sector Plan. It is clear that the climate change could have a devastating effect on tourism and plans needs to be put in place to cushion the expected effects. The tourism sector must respond by planning strategically, and must make wise choices.

Vision 2030: Jamaica National Development Plan

Vision 2030 and the Sector Policies (see section 4.1) contain a comprehensive treatment of climate change issues. It recognizes that a sustainable future requires effective measures to manage hazard risk and to incorporate climate change in future economic and land use planning.

Draft Jamaica National Climate Change Policy and Action Plan

The Draft JNCCPA (2010) needs to be finalized and submitted for Cabinet approval as a matter of priority. The Draft JNCCPA once approved would establish the framework for mainstreaming climate change considerations in all areas of government.

Agricultural Land Use Policy
The Agricultural Land Use Policy provides for the adaptation of climate smart farming techniques and choices as well as the exploration of accessible and affordable insurance and mitigation techniques to ensure sustainable farming. The Policy deals with climate change and its impact on agriculture and points out that lack of planning to identify vulnerable areas and long term adaptation strategies to mitigate the magnitude of climate impacts will encounter heavy losses and greatly impact the government's budget and other developmental activities.

Draft Forest Policy
The Draft Forest Policy does not provide an analysis of the previous policy and the performance of the FD (now the NFA); or its previous reforestation and afforestation efforts, which since the country is already experiencing some effects of climate change could act as baseline data to help determine which tree species are the most hardy, the areas best suited for their growth, and the best time of year to plant out the seedlings. Neither does it state that it will conduct studies to determine which endemic trees are best adapted to cope with climate changes.

Wetland Policy
There is no overarching and coherent policy framework for wetland management. A mangrove and coastal wetlands protection policy was prepared in 1996 but still remains in draft.

Other Policies Which Do Not Include Climate Change Considerations
Other policies which do not include climate change considerations are the Ocean and Coastal Zone Management Policy; the Draft Fisheries Policy; the National Health Policy; National Land Policy; Towards a Watershed Policy; Transport Policy; and various NRCA Guidelines.

Policies and Plans Which Include Some Climate Change Considerations
Policies, and plans which include some climate change considerations are National Forest Management and Conservation Plan; Towards a Beach Policy for Jamaica; National Hazard Mitigation Policy; Draft National Carbon Emissions Trading Policy; and National Renewable Energy Policy.

Legislation
International environmental agreements and conventions do not have direct legal authority at the national level and must be locally implemented through national legislation within appropriate institutional structures. Legislation can be used to incorporate conventions either by repeating the conventional provisions, or by referencing the convention, sometimes by reproducing the agreement in an Appendix to the Act.

The Constitutions of the Jamaica (like most others in the Caribbean) do not provide citizens with an inherent fundamental human right to a clean and healthy environment as they focus more on civil and political rights.

In the absence of constitutional protection of the right to a healthy environment, enactment of environmental legislation is under complete control of the government. While it is the government which is responsible for creating and adopting environmental laws, the Constitution enables the government to amend or repeal this very environmental legislation and Governments is often exempt from the scope of this legislation eg. the Housing Act and UDC operate outside the national planning framework as the Town and Country Planning Act and the Parish Councils Act do not bind the Crown.

There are many laws and regulations governing aspects such as land use and planning, protection of flora and fauna, fisheries, pollution of marine areas, beach protection, and public health. A range of institutions implements, monitors and enforces this environmental legislation. This fragmented approach can be considered an inadequate framework for environmental protection.

Over the years portfolio responsibility for environment management has shifted between different Ministries. The frequent reallocation of this portfolio in the past has reduced the country's ability to implement a comprehensive environmental strategy.

Required Legislation

The following legislation will be required:

- Building Code
- Town and Country Planning Act
- Environmental Management Act
- Meteorological Act
- Disaster Management Act
- Development Orders for Kingston and St. Andrew, Manchester, Santa Cruz and Negril
- Renewable Energy Act
- Conversion of Prime Lands to Non-Farm Uses
- Agricultural Zoning Orders
- Various NEPA Regulations
- Watershed Protection Act

1.7 Priority Areas

There are a number of key areas that require priority attention in the short or medium term. These may be broken down into institutional, policy, plans and legislative measures.

Institutional

Institutional areas include the creation of a Climate Change Unit to facilitate the coordination of all climate change activities across all aspects of government. Areas to be strengthened are NEPA, the WRA, ODPEM, and the Met. Office.

Public-Private linkages

Clearly climate change mitigation and adaptation are not the sole preserve of governments, as most activities which impact on the climate or, in turn, are impacted by a changing climate take place in civil society. Many promising climate change responses, especially in relation to mitigation, will involve the private sector, such as energy efficiency gains in industry, retrofitting buildings to conserve energy, and renewable energy providers. Governments can assist the private sector in taking up these activities through various incentives, through green procurement, and through public-private partnerships.

One key area where private sector involvement is essential is in amendments to national codes and standards, such as the engineering standards, building codes, or hurricane proofing standards. Often the best method is for the Government to set a specific target and request the private sector to find the best ways of achieving that target.

At the community level, NGOs have proven to be effective intermediaries between the government and the community. Governments should encourage active civil society involvement in all areas of climate change responses. Local and international NGOs may be particularly helpful in documenting and codifying traditional and indigenous adaptation measures, which may hold the key to future adaptation measures.

Policies

Policies to be revised to include climate change considerations are:

- Water Policy
- Forest Policy
- Ocean and Coastal Zone Management Policy
- Mangrove and Coastal Zone Wetlands Protection Policy
- Towards a Beach Policy for Jamaica (A Policy for the use of the Foreshore and the Floor of the Sea)
- Coral Reef Protection and Preservation Policy and
- Towards a Watershed Policy for Jamaica.

Plans

- A National Spatial Plan needs to be prepared

Guidelines

The current published setback guidelines need to be revised. Instead of being based on slope angles these should be related to local risk from present and future storm events, thus they should be site specific.

Legislation

At present the current policy and legislative framework is not adequate to respond to the ongoing requirements of climate change. Legislative measures required include:

- A new **Watershed Protection Act**
- A new **Town and Country Planning Act**
- **Water Resources (Amendment) Act** (Draft) to be finalized
- Finalization and promulgation of the **Development Orders and Development Plans** for **Kingston and St. Andrew, Manchester, Santa Cruz and Negril** whilst ensuring that climate change is mainstreamed into these Orders and Plans. **Existing Development Orders and Plans** need to be **revised** to ensure that they reflect climate change considerations.
- A new **Environmental Management Act** that will update the existing NRCA Act and also reflect climate change considerations. The revision of the Natural Resources (Prescribed Areas) (Prohibition of Enterprise, Construction and Development Order 1996 and the Natural Resources (Permits and Licences) Regulations to specifically include climate change considerations. Thus climate change considerations should be explicitly be integrated in the EIA process;
- A new **Disaster Management Act**
- Finalization and implementation of the **Fisheries Bill**
- The finalization and enactment of a **Metereological Act**
- The development and finalization of a **Renewable Energy Act**
- Establish legislation to include levying a prohibitive tax on the conversion and subdivision of prime lands to non-farm uses without approval.
- Enact a **National Building Act**
- Amend the **Housing Act**
- Amend the **Urban Development Corporation Act**
- Preparation of Agricultural Zoning Order/Districts
- Finalize the draft **Natural Resources (Portland Bight Protected Area) Regulations**;
- Review and amend the **Natural Resources (Air Quality) Regulations**, 2006;
- Review and revise the **Natural Resources (Montego Bay marine Park) Order & the Natural Resources (Marine Parks) Regulations**;

- Review and revise the **Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development Order)** 1996 and the **Natural Resources (Permits and Licences) Regulations**.

Prioritization of Legislation
In terms of priority the following legislation needs to be enacted during the 2012-2013 legislative agenda:

2012-2013
- Water Resources (Amendment) Act
- Disaster Management Act
- Town and Country Planning Act
- Meterological Act
- National Building Act and promulgation of the Building Code
- Renewable Energy Act

2013-2014
- Natural Resources (Air Quality) Regulations
- Natural Resources (Portland Bight (Protected Areas) Regulations)
- Agricultural Zoning Orders
- Finalization and promulgation of Development Orders for Kingston and St. Andrew, Manchester, Santa Cruz and Negril
- Environmental Management Act
- Amended Natural Resources (Prescribed Areas) (Prohibition of Enterprise, Construction and Development Order)
- Amended Natural Resources (Permits and Licences) Regulations

1.8 Human and Financial Resources to Incorporate Climate Change Concerns

A number of key agencies need to be strengthened to effectively incorporate climate change concerns. Among these agencies are the Meterological Department, the Water Resources Authority, NEPA, ODPEM, and the Ministry of Agriculture. Appendix 1 contains a more detailed framework of the resources required.

Since climate change affects everyone there should be capacity building of NGOs, and community groups.

2 INTRODUCTION

There is increasing evidence of human interference in the climate change system which has led to global warming. With the concern over global environmental issues, the United Nations General Assembly (UNGA) ADOPTED RESOLUTION 43/53 on the protection of the global climate for present and future generations. The UNGA in its resolution 45/202 provided the basis for the negotiations of a framework convention on climate change. Final negotiations with regards to the United Nations Framework Convention on Climate Change (UNFCCC) occurred at the United Nations Conference on Environment and Development (UNCED), Rio de Janeiro, Brazil, with the UNFCCC becoming open for signature on 4th June 1992. Jamaica signed on 12th June 1992 and ratified the UNFCCC on the 6th January 1995.

Compelling evidence indicates that global climate has changed compared to the pre-industrial era and is anticipated to continue to change over the 21st century and beyond. The Intergovernmental Panel on Climate Change (IPCC) declared that *"warming of the climate system is unequivocal."* The global mean temperature has increased approximately 0.76°C between 1850-1899 and 2001-2005 and the IPCC concluded that most of the observed increase in global average temperatures since the mid-20th century is very likely (> 90% probability) the result of human activities that are increasing greenhouse gas concentrations in the atmosphere. Discernible human influences now also extend to other aspects of climate, including ocean warming, increases in continental-average temperatures, temperature extremes and wind patterns. Widespread decreases in glaciers and ice caps and warming ocean surface temperature have contributed to sea level rise of an average of 1.8 mm per year from 1961 to 2003, but has been estimated at 3.1 mm per year from 1993 to 2003. The biological response of ecosystems and individual species has been recorded on every continent.

The IPCC has projected that the pace of climate change is very likely (> 90% probability) to accelerate with continued greenhouse gas (GHG) emissions at or above current rates, with the best estimate that globally averaged surface temperatures will rise by 1.8°C to 4.0°C by the end of the 21st century. Even if atmospheric concentrations of GHGs were stabilized at current levels, the Earth would continue to warm as a result of past GHG emissions and the thermal inertia of the oceans. The biological response to this continued warming and sea level rise would continue for several centuries.

Future changes in temperatures and other important features of climate will manifest themselves differently across the regions of the world. According to the IPCC, it is very likely that hot extremes, heat waves and heavy precipitation events will continue to become more frequent. It is likely that future tropical cyclones (typhoons and hurricanes) will become more intense, with larger peak wind speeds and more heavy precipitation associated with ongoing increases of tropical sea surface temperatures. There is less confidence in projections of a global decrease in numbers of tropical cyclones. The extension of the regions that will be

primarily affected by these extreme events with major tourism destinations highlights the need for awareness and preparedness for natural hazards at the local level through systematic capacity building and strategies for disaster risk management. Extra-tropical storm tracks are projected to shift poleward, with consequent changes in wind, precipitation and temperature patterns, continuing the broad pattern of observed trends over the last half-century. Observed decreases in snow cover are also projected to continue.

For Jamaica, as a small island developing state climate change is of critical importance. The impacts of a changing climate could have potentially a devastating effect. Sea level rise will cause increased coastal erosion rates, flooding, and compound the effect of extreme weather events such as hurricanes. Changes in weather patterns will affect water supplies and have negative effects on agriculture.

Jamaica's location within the Caribbean has imbued the island with natural geophysical and climatic characteristics, which include associated processes designated as natural hazards. The Caribbean plate margin and extensive fault systems make the island prone to earthquakes, and the geology and topographic form increase the susceptibility to landslides. The latitudinal location exposes Jamaica to extreme climatic events, so heavy rainfall from tropical systems, tropical storms and hurricanes produce flooding on a regular basis. Statistical reviews indicate that there has been over the past 100 years at least one major destructive flood event every four years. Indeed, since 2000 there have been annual visitations of flood-producing rainfall in different parts of the island. Wind damage and storm waves are associated with storms and hurricanes, and these too have been occurring with greater frequency over the past ten years.

Approximately 82% of the population lives along the coastline, which accommodates the island's major cities and towns. Consequently, coastal hazards have significant impact on the social and economic wellbeing of the country. Significant destruction of life and property from natural hazards has taken place along coastal areas over the period of recorded history, but the significance of coastal hazards has been underscored in the past three decades in particular by the overwhelming proportion of foreign direct investments in tourism development projects and growth of urban settlements along the coastline.

Along with increased revenues from tourism there are associated demographic shifts, including increased squatting and its associated stress and damage to existing infrastructure and the environment, as well as demand for additional resources and facilities.

The review of disasters over the period 1900-2012 by the Centre for Epidemiological Research on Disasters (CRED) revealed some instructive findings. Seven of the top ten disasters in Jamaica's recorded disaster history in terms of persons affected, occurred during the period 1979-2008 and the most costly disasters occurred between 1988 and 2010 from storms or hurricanes. Climate change will likely cause an increase in these types of disasters and this would likely have serious economic impacts.

Table 1. Top 10 Natural Disasters in Jamaica for the Period 1900 to 2012 Sorted by Numbers of Total Affected People.

Disaster	Date	No. Total Affected
Storm	12-Sept-1988	810,000
Flood	12-May-1991	551,340
Storm	11-Sep-2004	350,000
Flood	12-Jun-1979	210,000
Drought	Jan-1968	100,000
Storm	18-Nov-1912	94,820
Earthquake (seismic activity)	14-Jan-1907	90,000
Flood	25-Apr-1979	40,000
Flood	15-May-1986	40,000
Storm	20-Aug-2007	33,188

Source: EM-DAT: The OFDA/CRED International Disaster Database, www.emdat.be, 2012

Table 2. Top 10 Natural Disasters in Jamaica for the Period 1900 to 2012 Sorted by Economic Damage Costs.

Disaster	Date	Damage (000 US$)
Storm (Hurricane Gilbert)	12-Sept-1988	1,000,000
Storm (Hurricane Ivan)	11-Sep-2004	595,000
Storm	13-Aug-2004	300,000
Storm (Hurricane Dean)	20-Aug-2007	300,000
Storm	29-Sep-2010	150,000
Flood	15-May-1986	76,000
Storm (TS Gustav)	28-Aug-2008	66,198
Storm (Hurricane Allen)	31-Jul-1980	64,000
Storm (Hurricane Charlie)	17-Aug-1951	56,000
Storm	6-Nov-2001	55,487

Source: EM-DAT: The OFDA/CRED International Disaster Database, www.emdat.be, 2012

2.1 International Conventions

2.1.1 United Nations Framework Convention on Climate Change (UNFCCC)

Jamaica signed on to the United Nations Framework Convention on Climate Change (UNFCCC) on September 6th, 1996. Jamaica has since participated in a number of regional projects to build capacity at the national level to address climate change.

With the concern over global environmental issues, the United Nations General Assembly (UNGA) adopted resolution 43/53 on the protection of the global climate for present and future generations. The UNGA in its resolution 45/202 provided the basis for the negotiations of a framework convention on climate change. Final negotiations with regards to the United Nations Framework Convention on Climate

Change (UNFCCC) occurred at the United Nations Conference on Environment and Development (UNCED), Rio de Janeiro, Brazil, with the UNFCCC becoming open for signature on 4th June 1992. Jamaica signed the 12th June 1992 and ratified the UNFCCC on the 6th January 1995.

As a party to the UNFCCC, Jamaica like all parties is subject to a number of commitments, which place obligations on Jamaica to respond to climate change. Articles 4 and 12 of the UNFCCC outline the commitments for countries. Under Article 12 countries are required to communicate to the Conference of Parties through the secretariat (i) A national inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, to the extent its capacities permit using comparable methodologies to be promoted and agreed upon by the Conference of the Parties, (ii) A general description of steps taken or envisaged by the party to implement the Convention (iii) Any other information that the Party considers relevant to the achievement of the objective of the Convention and suitable for inclusion in its communication, including, if feasible, material relevant for global emission trends.

Jamaica has submitted the Second National Communication to the Intergovernmental Panel on Climate Change (IPCC). The Mainstreaming Adaptation to Climate Change (MACC) Project under the Caribbean Community Climate Change Centre (CCCCC) has provided support to Jamaica to prepare a strategy for the water sector to adapt to the adverse effects of climate change. The sector strategy will be informed by projections; an analysis of the institutional framework within which the sector operates; an assessment of the economic impact of climate change on the sector; and a review of current policies and legal instruments.

2.1.1.1 Kyoto Protocol

The Kyoto Protocol is an amendment to the international treaty of United Nations Framework Convention on Climate Change (UNFCCC) which is a legally binding agreement under which more than 169 industrialized countries have agreed to reduce greenhouse gas emissions to a level of 5.4% by 2012 keeping 1990 as the base. The objective of the protocol is the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Under this protocol, about 38 industrialized countries and the European Union forms a part of Annex 1 list, the remaining are part of Non-Annex 1 list of countries. The Carbon market is the brainchild of the Kyoto Protocol for controlling greenhouse gas emissions. Greenhouse gases are emitted mainly by burning oil, gas, and coal that are resulting in perilous climate change. Each carbon credit represents one tone of carbon dioxide either removed from the atmosphere or saved from being emitted.

2.1.2 Regional Requirements

2.1.2.1 CARICOM

The Liliendaal Declaration was issued by the Heads of State of Government of the Caribbean Community (CARICOM) at the thirteenth meeting of the conference in Liliendaal, Guyana from 2-5th July 2009. The declaration recalled the objective, principles and commitments of the UNFCCC and its Kyoto protocol. It emphasized that dangerous climate change is already occurring in all SIDS (small islands and low-lying coastal developing states) and that many SIDS will cease to exist without urgent, ambitious and decisive action by the international community to reduce global greenhouse gas emissions significantly and to support SIDS in their efforts to adapt to the adverse impacts of climate change, including through the provision of increased levels of financial and technical resources.

The Declaration also indicated that the estimated total annual impact of potential climate change on all CARICOM countries is estimated at US$ 9.9 billion in the total gross domestic product (GDP) in 2007 US$ prices or about 11.3% of the total annual GDP of all 20 CARICOM Countries (member states and associate member states) according to the World Bank estimates.

It is against this backdrop that the CARICOM heads declared, *inter alia*, to strengthen educational institutions to provide training, education, research and development programs in climate change and disaster risk management particularly in renewable and other forms of alternative energy, forestry, agriculture, tourism, health coastal zone management and water resource management to increase the regions' capacity to build resilience and adapt to climate change.

2.1.2.2 Policy Level Actions

Caribbean countries have recognized the need for regional cooperation to enhance their capacity to adapt to the projected, multifaceted impacts of climate change. Numerous regional initiatives have therefore emerged in the Caribbean to support research, capacity building and policy integration in the area of adaptation. Much of this work has occurred through the CARICOM. In particular, a series of projects implemented by CARICOM have helped to understand the region's vulnerabilities to climate change, build capacities, engage in adaptation planning, support mainstreaming of adaptation into policy processes, and begin implementation of adaptation measures. These projects are: “Caribbean Planning for Adaptation to Climate Change” (1997-2001); “Adaptation to Climate Change in the Caribbean” (2001-2004); “Mainstreaming Adaptation to Climate Change” (MACC) (2004-2009); and the “Special Program on Adaptation to Climate Change: Implementation of adaptation measures in coastal zones” (2007-2011).

The Caribbean Planning for Adaptation to Climate Change (CPACC) Project (1998-2001):

Since April 1997, the Organization of American States (OAS) as the executing agency, and the World Bank as one of the implementing agencies of the Global Environment Facility (GEF), in collaboration with the University of the West Indies (UWI), the CARICOM Secretariat and other regional agencies have been engaged in the implementation of a four year project entitled "Caribbean Planning for Adaptation to Climate Change" (CPACC). The overall purpose of CPACC was to support Caribbean countries in preparing to cope with the adverse effects of Global Climate Change (GCC), particularly sea-level rise, on coastal areas through vulnerability assessment, adaptation planning and capacity building.

The project is being coordinated through a Regional Project Implementation Unit (RPIU) based in Barbados, as well as National Focal Points (NFPs) based in each participating country. The project followed a regional approach through a combination of national pilot/demonstration actions and regional training and technology transfer activities to achieve its objectives.

Some of the specific objectives are to:

1. Strengthen regional capacity for monitoring and analyzing climate and sea level dynamics and trends in order to determine potential impacts of GCC;

2. Identify socioeconomic, environmental and geographic areas, which are particularly vulnerable to the adverse effects of GCC;

3. Develop an integrated management and planning framework for cost effective responses and adaptation to the impacts of GCC on coastal and marine areas;

4. Enhance regional and national capabilities in preparation for the advent of GCC through institutional strengthening and human resource development; and;

5. Identify and assess policy options and instruments that may help initiate the implementation of a long-term program of adaptation to GCC in vulnerable coastal areas.

The adaptation to climate change in the Caribbean (ACCC) Project (2001-2004):

This was a CIDA-funded initiative that provided an effective bridging facility between CP ACC and the mainstreaming adaptation of climate change (MACC) project. It built on the foundation laid by CPACC, including the addressing of some of the gaps identified during the implementation of the CPACC project. This project facilitated the

establishment of the Caribbean Community Climate Change Centre (CCCC) located in Belmopan, Belize in 2003.

Mainstreaming Adaptation Climate Change (MACC) Project (2003-2009):

The Mainstreaming Adaptation to Climate Change (MACC) Project was a four-year (2003-2007) initiative funded by the Global Environmental Facility (GEF) for the Caribbean region to build capacity in the CARICOM SIDS, (participating countries included: Antigua & Barbuda; The Bahamas; Barbados; Belize; Dominica; Grenada; Guyana; Jamaica; Saint Kitts and Nevis; Saint Lucia; Saint Vincent & the Grenadines; Trinidad & Tobago), to develop Stage II adaptation strategies and measures (as defined by the Conference of Parties to the UNFCCC) through the mainstreaming of adaptation into the general planning process of the countries in the region.

The project had four components:

- Mainstreaming adaptation to climate change in national development planning and public and private sector strategies;

- Supporting the formulation of a regional strategy on adaptation and specific measures for adaptation (demonstration pilots);

- Expanding and strengthening the existing knowledge base to facilitate Global Climate Change impact assessment as a basis for decision making on adaptation;

- Public Education and Outreach including Cross-regional dissemination and replication.

Special Program for adaptation to Climate Change (SPACC)

This World Bank/GEF project was launched in February 2007 with an aim to support efforts by Dominica, Saint Lucia and Saint Vincent and the Grenadines to implement specific (integrated) pilot adaptation measures. These adaptation measures were to address the impacts of climate change on the natural resource base of the region, focused on biodiversity and land degradation along coastal and near-coastal areas.

Consequently, the SPACC project aims to reduce the impacts of decreasing freshwater availability by the installation of a salt water reverse osmosis (SWRO) plant to provide to the residents of Paget Farm a clean, adequate and reliable supply of potable water which would also be distributed directly to the homes using a metered water distribution system. The project will also install a renewable energy source to not only offset the cost of producing freshwater by the SWRO plant, as well as to ensure that the water that is produced is affordable to the residents.

Out of these regional initiatives emerged the Caribbean Community Climate Change Centre, which serves as the official repository and clearing house for regional climate change data and provides climate change-related policy advice and guidelines to CARICOM Member States. As well, building upon the MACC project, a roadmap for adaptation action in the Caribbean was created, Climate Change and the Caribbean: A Regional Framework Achieving Development Resilient to Climate Change (2009-2015). The Regional Framework identifies a number of strategic goals for the region, including: mainstreaming climate change into Caribbean countries' sustainable development agendas; addressing the impact of climate change on freshwater supply, human health and coastal and marine ecosystems; and moving forward on low-carbon development within the region. An implementation plan for this Framework has recently been developed.

The Caribbean Catastrophe Risk Insurance Facility (CCRIF) also provides support to Caribbean countries by enhancing their capacity to respond to extreme weather events. It allows states to purchase insurance against hurricanes and natural disasters, and thereby provides immediate liquidity to Caribbean governments after these catastrophic events. It is the first multi-country risk pool in the world.

At the national level, Caribbean countries have recognized the need to integrate adaptation into development policies and plans, and are beginning to act upon this understanding. For example, the Dominican Republic has prepared a National Adaptation Plan of Action and made some progress with the integration of adaptation into national policy, such as the inclusion of climate change adaptation in its National Development Strategy (MEPD and CNRE, 2010). The Dominica, Saint Lucia, and Saint Vincent and the Grenadines have also main streamed adaptation measures into their development policies and are currently piloting adaptation measures to improve existing strategies.

Needs and gaps

Countries of the Caribbean region have been actively engaged in adaptation action at the policy and program level since the late 1990s. Through these initiatives, Caribbean countries have built their capacity to analysis climate change vulnerabilities, mainstream adaptation action into development agendas, and are now beginning to implement actions on the ground to further improve adaptation main streaming outcomes. Many of these actions emphasize the need for an ecosystem-based approach to adaptation, such as through integrated coastal zone management and integrated watershed management. There is national and regional recognition that ecosystem services can greatly reduce adaptation costs while providing numerous co-benefits (i.e., mangroves and reefs protect shorelines from erosion and supply fisheries; forests mitigate landslides, flooding and drought).

Building upon the MACC project, the United Kingdom's Department for International Development (DFID) and the Global Environment Facility (GEF) supported a two-year project that created a roadmap for adaptation action in the Caribbean: Climate Change and the Caribbean: A Regional Framework for Achieving Development Resilient to Climate Change

(2009-2015). The Regional Framework identifies a number of strategic goals for the region, including: mainstreaming climate change into Caribbean countries' sustainable development agendas; addressing the impact of climate change on water supply, health and coastal and marine ecosystems; and moving forward on low-carbon development within the region. The CCCCC has the primary responsibility for coordinating implementation of the Regional Framework, including responsibility for liaising with national governments and relevant regional organizations. These organizations include the Caribbean Meteorological Organization, the Caribbean Tourism Organization, the Caribbean Development Bank, the Caribbean Institute for Meteorology and Hydrology, and the Organization for Eastern Caribbean States. An Implementation Plan has recently been developed for the Framework in partnership with the Climate and Development Knowledge network and supported by DFID. It outlines priority actions for local, national and regional adaptation identified during extensive national and regional consultations with stakeholders.

The successor to the MACC project (2007-2011) is the "Special Program on Adaptation to Climate Change: Implementation of adaptation measures in coastal zones" (SPACC). SPACC is piloting adaptation measures in countries that have already mainstreamed adaptation across sectors to better address the impacts of climate change on biodiversity and land degradation in coastal zones.

2.1.2.3 St. Vincent and the Grenadines

St. Vincent and the Grenadines (SVG), as a result of signing the United Nations Framework Convention on Climate Change, is mandated to fulfill a number of obligations under the convention. For example, according to article 4.1 of the convention Saint Vincent is required to "Take climate change considerations into account. To the extent feasible, in their relevant social, economic and environmental policies and actions, and employ appropriate methods, for example impact assessments, formulated and determined nationally, with a view to minimizing adverse effects on the economy, on public health and the quality of the environment, of projects or measures undertaken by them to mitigate or adapt to climate change".

St. George's Declaration (SGD) and National Environmental Management Strategy (NEMS)

The St. George's Declaration (SGD) of Principles for Environmental Sustainability in the GECS was signed by the GECS Ministers of the Environment in April 2001. The declaration sets out the broad framework to be pursued for environmental management in the GECS region. The SGD has 21 principles, and principle 8 is aimed at addressing the causes and impacts of climate change.

The National Environment Management Strategy (NEMS) is the mechanism by which the SGD is implemented. The NEMS for SVG contains two broad strategies (27 and 28) which give effect to principle 8 of the SGD. Strategy 27 speaks to establishing

appropriate and relevant integrated strategies, plans and policies to adapt and respond adequately and in a timely fashion to the causes and impacts of climate change while Strategy 28 allows for collaboration at the regional and international levels, in the implementation of obligations under the United Nations Framework Convention on Climate Change.

Draft National Climate Change Adaptation Policy

This document highlights the potential impacts of Climate Change on various sectors such as coastal and marine, agriculture and forestry, water resources, human settlement, socioeconomic development, tourism and human health in SVG.

It is also an attempt to integrate climate change concerns into the development plans of the relevant sectors/ministries. Consequently, the appropriate adaptation measures may be taken to reduce the potential impacts of climate change and climate variability on SVG.

The objectives of the National Climate Change Adaptation Policy are:

1. To develop management strategies and approaches which should:

    - Increase public awareness with regard to climate change issues;

    - Reduce or avoid damage to settlement and infrastructure caused by climate change and sea level rise;

    - Minimize damage to beach and shoreline integrity and marine ecosystems caused by climate change; and

    - Avoid or minimize the negative impact of climate change on human health.

2. To develop economic incentives to encourage investment in public and private sector adaptation measures.

3. To develop appropriate legislative/regulatory framework, for proper environmental management, and institutional systems for planning and responding to climate change.

SVG is one of the countries participating in the PPCR and in Phase I will be reviewing the existing legislative framework to address Climate Change, as well as the Climate Change Adaptation Policy. The Climate Change Adaptation Policy will be revised and reviewed. Revision of the document will be done through a consultative process, and will ensure that the Strategic Programme for Climate Resilience (SPCR) is

appropriately aligned and provides an opportunity to propose policy changes if deemed necessary.

The review of the legislative framework is expected to make recommendations and develop a strategy for the mainstreaming of climate change concerns into existing legislations. The expected outcome is the development of improved legislation (laws, policies, regulations) to assist Saint Vincent and the Grenadines to develop in a more sustainable manner. It is anticipated that revisions to existing legislation will be undertaken during Phase II.

There will be a review of fiscal regimes that seek to address climate change: Such a review would compile past, current and planned regimes (e.g. regimes on the importation of water saving mechanisms and energy efficient systems) and include recommendations for the improvement of the regimes that would encourage the adoption of appropriate policies and best practices, in Saint Vincent and the Grenadines, related to climate change.

2.2 Mainstreaming Climate Change

Jamaica has taken several initiatives to mainstream climate change into its national developmental processes and mechanisms, chief among these is the Vision 2030 National Development Plan. Vision 2030 specifically has climate change incorporated as one of its 15 outcomes (Hazard Risk Reduction and Adaptation to Climate Change), but climate change is infused throughout the entire document.

A National Water Sector Policy was approved by the Government of Jamaica (GoJ) in January 1999, and is currently under review. The Water Resources Development Master Plan has been finalized and a National Irrigation Development Plan (1997) is in place. Of additional relevance are the Forestry Master Plan and the Vision 2030, being spearheaded through the Planning Institute of Jamaica (PIOJ). Vision 2030, a national development plan to the year 2030, includes task forces focused on the Water Sector, Natural Resources Management and Climate Change and Natural Hazard Reduction, Urban and Regional planning as well as several sector and social themes.

Jamaica's Second National Communication to the UNFCCC assesses some of the expected effects on the coastal zone from future changes to sea-level rise. These include proposed measures for adapting to sea-level use. The most important involves a thorough revision of the present and published setback guidelines. The Second National Communication also points out the need for beach nourishment projects.

Jamaica is also the sole Caribbean participant in two global projects. It is one of 10 countries in which local level adaptation action is being supported through the "Community-based Adaptation to Climate Change Program" financed by the GEF through UNDP. It is also part of the European Commission's "Global Climate Change Alliance" which is financing priority adaptation measures in 18 vulnerable countries around the world.

The European Union funded Climate Change Adaptation and Disaster Risk Reduction project will seek to address issues of:

- Environmental degradation
- Jamaica's high vulnerability to climate change impacts
- Inadequate mainstreaming of climate change issues into sectoral plans and national policies.
- Lack of awareness about climate change

The **main objective** of the EU project is to assist Jamaica with its adaptation to climate change and to contribute to sustainable development by increasing the resilience of vulnerable areas and reducing the risks that are associated with natural hazards, particularly in vulnerable communities. The PIOJ will ensure that there is no duplication of effort between the PPCR and the EU project, and that work in the PPCR will contribute to/guide the efforts of the EU project.

2.3 Flood Events

Within the past decade from 2000-2010, Jamaica has suffered several extreme flood events that have wreaked havoc on infrastructure and livelihoods. Several flood events occurred in 2000, 2001 and 2002, and in 2004 the island was struck by Hurricanes Charley in June and Ivan in September. Charley caused severe damage to agriculture in the southwestern parishes, and Ivan caused wind and flood damage in most parishes across the island. Severe erosion within the coastal zone and in the watersheds caused losses to housing and infrastructure. The high exposure to risk and the lack of awareness of vulnerable populations was marked.

A national review of the response to Ivan was undertaken through stakeholder consultations and reporting from key sectors and committees. The findings highlighted shortcomings at the parish level and in the national response system including utilities, health, and shelters.

In 2005 Hurricanes Dennis, Emily and Wilma passed within sufficiently close proximity to Jamaica to discharge tons of rainfall that in turn caused further damage to infrastructure and livelihoods. Hurricane Dean damaged the southern parishes in 2007. The main road to the Norman Manley International Airport in Kingston was overtopped by storm surge as the dunes and coastal defence works had not been restored/ enhanced following the

destruction by Hurricane Ivan.

In 2008 Hurricane Gustav again resulted in heavy rainfall in many parts of the island causing severe damage and dislocation to livelihoods and infrastructure. The exposure of vulnerable populations and the limitations of the national response mechanism were repeatedly highlighted.

2.4 Vulnerable Sectors

Changing rainfall patterns, sea level rise, increasing temperatures and extreme weather events are some of the adverse impacts of climate change and climate variability that will have serious environmental, social and economic consequences in Jamaica. As a result, several sectors are vulnerable.

The vulnerable sectors include *inter-alia*:

- Agriculture
- Coastal Zone
- Critical Infrastructure
- Energy
- Fisheries
- Health
- Land use
- Tourism
- Water

2.5 Climate

Forecasts for future climate in Jamaica to the 2080s were made, with some spatial variability through the use of the dynamic regional climate model called PRECIS and statistical downscaling at specific locations because IPCC projections are based on low resolution models which simulate changes applicable to a large region as a whole (approximately 300km x 300km). They do not distinguish climate response over smaller regions such as the parishes of Jamaica. It was therefore necessary to downscale the results of these low resolution models to distinguish climate response over the small regions of Jamaica. This was done using PRECIS, which uses physical equations to simulate climate processes, and a statistical model called SDSM, which uses statistical relationships to project future processes.

Precipitation changes for 2015, the 2030s, 2050s and 2080s have been simulated over 7 regions of Jamaica by use of the PRECIS model. For the same periods,

precipitation changes for 3 stations (Manley, Sangster and Upper Rio Cobre River) and streamflow changes for 3 stations (Great River at Lethe, Rio Grande River at Fellowship and Hope River at Gordon Town) were downscaled by SDSM. Changes in wet spell and dry spell lengths were also produced by SDSM.

Most areas will begin to show decreases in precipitation by the 2050s and 2080s. The drying effect is noted all over Jamaica and the results indicated that the results are all significant by the 2080s.

2.5.1 Temperature

The comparison of results from the GCMs, PRECIS and SDSM provides a means of assessing the confidence in results. The general agreement among GCMs that temperatures will increase, gives a high probability that increases will occur in the Caribbean. The probability is increased because of agreement with other regional and statistical downscaling research (Taylor *et al*, 2007 and Chen *et al*, 2006), and because the science of global warming is well understood and almost universally accepted. The temperature increase will depend on the future emissions. Under the A1B scenario, temperatures in the Caribbean are expected to rise by about 1.5^0C by 2050s and be just under the global average of 2.8^0C by the end of the 21^{st} century.

2.5.2 Precipitation

Most GCM simulations of future Caribbean precipitation show a decrease in annual values, especially in June, July, and August, by the end of the century under the A1B scenario. However, the precipitation signal does not become significant until the latter half of the century. The PRECIS and SDSM results for A2 and B2 scenarios support the general trend and the probability is therefore high that decreases in precipitation will occur, especially by the 2080s. The magnitude of the decrease however is uncertain.

Precipitation is projected to decrease by the 2030s, and for the 2050s, the decrease is projected at 10% for some areas of the island, and by the 2080s, it is projected to decrease by as much as 40% for some areas of the island.

By the end of the century sea levels are also expected to rise by 0.21 to 0.48 meters under an A1B scenario, but the models exclude future rapid dynamical changes in ice flow. A recent study suggests that the rate of rise may actually double (ScienceDaily, 2008). Evaporation is also projected to increase by approximately 0.3 mm/day over the sea. The changes over land may be less. One model has projected more hurricanes and more intense hurricanes in the Atlantic.

2.6 Mitigation and Adaptation to Reduce Dangerous Climate Change

Climate change mitigation is action to decrease the intensity of radiative forcing in order to reduce the potential effects of global warming. Mitigation is distinguished from adaptation to global warming, which involves acting to tolerate the effects of global warming. Most often, climate change mitigation scenarios involve reductions in the concentrations of greenhouse gases, either by reducing their sources or by increasing their sinks.

The UN defines mitigation in the context of climate change, as a human intervention to reduce the sources, or enhance the sinks of greenhouses gases. Examples include using fossil fuels more efficiently for industrial processes or electricity generation, switching to renewable energy (solar or windpower), improving the insulation of buildings and expanding forests and other "sinks" to remove greater amounts from carbon dioxide from the atmosphere.

Adaptation to global warming and climate change is a response to climate change that seeks to reduce the vulnerability of material and human systems to climate change effects.

Many scientists and international organizations are now advocating significant cutbacks in greenhouse gases (mitigation) in order to limit temperature rises to less than 2^0C during this century (UNDP, 2007). Several countries of the European Union have given commitments to these drastic reductions. The Governments of France and the United Kingdom, for example, have stated their intention to cut emissions by approximately 80% by 2050.

However, this does not mean that we should stop planning adaptation strategies. In the first place, the chances of limiting temperature rise to less than 2^0C are slim because of economic and political hurdles. Energy Information Administration (Washington, DC), in its International Energy Outlook 2008 report released in June, predicts that world energy demand and carbon dioxide emissions will grow by about 50 percent over the next two decades. In the second place, the adaptation measures recommended herein are still applicable, regardless of climate change, and should be considered as 'no regrets' strategies.

2.7 Current Climate Change Data

The most recent report of the United Nations Intergovernmental Panel on Climate Change (IPCC) concluded that it was "very likely" that such human activity was responsible for a majority of the warming observed during the latter part of the twentieth century. The IPCC further predicted that the global mean temperature will continue to rise over the next century, as much as several degrees Celsius, as

atmospheric concentrations of greenhouse gases continue to rise.

The precise nature and degree of the human contribution to global warming is unknown, and may even be unknowable given the extent of natural variation and the complexity of the global climate system. Nonetheless, there is strong reason to believe human activity is contributing to significant changes in the atmosphere, with potential consequences for current and future generations. Even climate scientists with reputations as "skeptics" or "deniers" of climate change acknowledge the likelihood that anthropogenic emissions will produce some amount of global warming, albeit less than predicted by the IPCC and the computer models upon which it relies. Appendix 3 gives a summary of climate change issues, and Appendix 4 gives climate change impacts and possible adaptation measures.

2.8 Emerging Issues

2.8.1 Property Rights

The predicted increase in global temperature is expected to produce various environmental effects that have implications for private property rights, particularly an increase in sea level, increased precipitation and flooding, and changes in agricultural productivity. Global sea level, for example, is expected to rise anywhere from eighteen to fifty-nine centimeters, or more, by the year 2100 as a consequence of predicted atmospheric warming.

Nations, particularly wealthy nations, are fully capable of adapting to changes in sea level. Some already have. That is not the problem, however. The question is whether those nations most vulnerable to sea-level rise should bear the cost of protecting themselves against such effects, particularly if they have made no significant contribution to the atmospheric changes that cause (or at least contribute to) the sea-level rise.

Even if anthropogenic climate change is less than catastrophic, it appears likely to have effects on property rights that would be considered nuisances under the common law principles endorsed by most Free Market Environmentalism (FME) proponents. Actions that caused downstream flooding, denial of the "natural" flow of waterways, or other kinds of interference with another landowner's quiet enjoyment of his/her land could be actionable at common law and would be recognized as infringements upon private property rights by FME proponents even if legal remedies were unavailable. By the same token, whether or not current legal institutions would recognize causes of action against human contributions to climate change, and whether or not legal institutions exist that are capable of adjudicating such claims, it seems that some of the predicted consequences of global warming, such as an increase in sea level and consequent flooding, would constitute property-rights violations under the theory of FME.

Government is only liable for malfeasance[4], not nonfeasance.

2.8.2 Carbon Trading

Global warming is the current topic in the political agenda across the globe. Every country seems to be spending lot of time, energy, and money to find solutions to one of the major international problems of climatic change. Some of such initiatives are the UN framework convention 1992 on climate change, and the emergence of the Kyoto Protocol 1997, and the Bonn Agreement of 2001. Under these initiatives developed countries unanimously agreed to reduce greenhouse gas emission to save the planet from potential danger and provide a clean and healthy environment for human life. Global warming is caused by greenhouse gases and it is presumed to be the greatest threat to the entire human life if it is not handled in an adequate manner.

Economists consider it as a new idea of converting this threat to an opportunity and utilizing this opportunity for the betterment of the environment while attaching monetary value with economic benefits. They propagate creating a monetary tool for mitigation of drastic climatic changes, which has immense benefits on human life and acts as a central tool for liquidity in the economy while reducing the emission of greenhouse gases. The idea generated is the brand new financial product called Carbon Trading. Carbon Trading is the brainchild of the Kyoto Protocol 1997.

Carbon Trading is in its nascent stage in terms of development, which requires time and effort to be groomed as one of the matured markets. The estimated market value of the Carbon Trading was approximately $30 billion U.S. dollars in the year 2006.

Carbon Credits Trading or Emission Trading refers to trading in Greenhouse gas emission certificates within the legal framework. It is a market-based scheme for environmental improvement that allows parties to buy and sell permits for emissions or credits for reductions. Emissions trading allow established emission goals to be met in the most cost-effective way by letting the market determine the lowest-cost pollution abatement opportunities.

Under such schemes, the environmental regulator first determines the total acceptable emissions and then divides this total into tradable units (often referred to as credits or permits). These units are then allocated to scheme participants with dual purpose while allowing the flexibility to meet their emission targets according to their own strategy.

[4] Malfeasance is doing something deliberate to create harm. Nonfeasance is generally the failure to intervene to confer a benefit upon another or to prevent injury to another.

- Participants who emit pollutants must obtain sufficient tradable units to compensate for their emissions;

- Participants who reduce emission may have surplus units that they can sell to others, who find emission reduction more expensive or difficult.

Jamaica has prepared a draft Carbon Emissions Trading Policy, see section 5.5

2.9 Institutional Responsibilities

The following institutions were selected because of their direct relevance to climate change adaptation and/or mitigation:

- National Environment and Planning Agency
- The Forestry Department
- National Meteorological Service
- National Water Commission
- The Water Resources Authority
- The National Irrigation Commission
- NGOs and Community Groups

2.9.1 National Environment and Planning Agency

The management of watershed protection is vested principally with the National Environment and Planning Agency (NEPA). NEPA produced a National Watershed Policy to address the most severe constraints to watershed management and to seek to employ strategies to ensure the sustainable use and development of watersheds. The policy states the essential elements of a national watershed management initiative. It seeks to define opportunities for the people, for the government and nongovernment organizations, and for the international community to participate in the sustainable management and conservation of watersheds of Jamaica in the interest of water supply and bio-diversity. There are 12 guiding principles to the Policy, among which are included:

- Long term watershed management;

- The design, planning and implementation of watershed management interventions;

- Special attention to people in watershed areas and their environment;

- Integral protection and production functions for land and water resources;

- Assessment of land use impacts and rehabilitation of damages;

- Compromise rather than confrontation and complimentary rather than contradictory in resolving conflicts of interests;

- Co-operation among agencies and the public to manage watersheds effectively.

The Watershed Protection Act (1963) is the law governing watersheds and is administered by NEPA. The primary focus of the Act is the conservation of water resources by protecting land in or adjoining the watersheds. The Act is intended to ensure proper land use in vital watershed areas, reduce soil erosion, maintain optimum levels of ground water, and promote regular flows in waterways.

There have been a significant number of NEPA Initiatives. These include completing a NEPA Climate Response Strategy (2009), monitoring of CPACC coral reef sites, monitoring of beach sites affected by critical coastal erosion, integrating disaster risk management criteria into the EIA process, incorporating energy conservation criteria into the EIA process, promotion of EMS and environmental stewardship programmes within the public and private sectors and the production of climate change education material.

2.9.2 The Forestry Department

The Forestry Department (FD) is mandated, amongst other responsibilities, to conserve and protect the island's forests, and to manage the protected forested areas in watersheds. The Forestry Department's watershed management function is described as “protection and preservation of watersheds in forest reserves, protected areas and forest management areas” (Forest Act, 1996). The Department has no jurisdiction over private lands within a watershed. Such management is a key component supporting the sustainability of Jamaica's water resources.

To support its activities, the FD has prepared and published the National Forest Management and Conservation Plan (Forestry Department, 2000). This document explicitly outlines one of the key values of forestry to Jamaica as supporting the water resources functions of forested watersheds, as well as soil conservation, protection of biodiversity and carbon sequestration. The Plan includes the development of a number of strategies to support the Plan's objectives. With respect to water resources, the most relevant strategy relates to Forest Protection. This includes a number of activities starting with forest inventory, development of guidelines on forest land use, identification of critical emphasis areas, and development of conservation and protection strategies, declaration of Forest Reserves, Forest Management Areas and Protected Areas, and restoration of mining disturbed forests. The Plan includes an implementation programme and budget for a number of activities and projects. It was adopted by the GoJ and has a 5-year implementation programme.

The FD has also undertaken a number of detailed catchment/watershed based studies, with its

Trees for Tomorrow project, looking at strengthening the Department's abilities to plan and manage forests and develop and implement soil conservation measures appropriate to Jamaica's environment. To assist the accomplishment of this aim, the Rio Minho, the Martha Brae and the Buff Bay/Pencar watersheds were chosen as Watershed Management Unit (WMU) models for further study. From this work, two reports (Trees for Tomorrow Project, 2002 & 2004) were produced which summarised the main physical-morphometric characteristics and the modification of the land-use conditions of the watershed, and how this has influenced their hydrological responses, investigated linkages between forest cover and watershed yield as well as recommending appropriate land treatments for erosion control.

Other activities of the FD include replanting, agroforestry, protecting watersheds, land stabilization and river training, and watershed activities in the Yallahs and Hope River, setting up local forest management units, agroforestry, the planting of trees and the declaring of forest reserves.

In addition the FD has been involved in data collection for the monitoring of climate change.

2.9.3 National Meteorological Service

The Weather Branch of the National Meteorological Service (Met. Serv.) is concerned with the observation and forecasting of weather conditions over and around the island. It consists of a Radar Section that closely monitors and reports on rainfall occurrence within a range of nearly 500 kilometres; an Upper-Air Station (the Caribbean Rawinsonde Network Section) that monitors the characteristics of the upper atmosphere; a Synoptic Sub-Station operating within the Sangster International Airport in Montego Bay that makes observations and meteorological reports for use in international air navigation; and a National Meteorological Centre at the Norman Manley International Airport that provides weather forecasting services for general dissemination.

This Section, in particular, maintains a continuous Hurricane Watch during the hurricane season and is responsible for the issuance of severe weather warnings. Data for forecasts are obtained locally from observation points at the surface, as well as from the radar station, and internationally through telecommunication links with regional and international centres and via stationary and polar orbiting satellites.

Additionally, technicians working within the Weather Branch’s Instruments and Equipment Section are responsible for maintaining all meteorological and other related machinery that reside in the various Sections.

Based at the Meteorological Headquarters, the Climate Branch is responsible for maintaining a current database of the climate of Jamaica and for the utilization of this data in informing productive sectors of the country. It consists of a Data Acquisition Section that sets up and maintains an island wide network of rainfall and climatological stations; a Data Processing

Section that gathers, archives and analyses the climatological data with a view to monitoring and assessing the climate of the island; and an Applied Meteorology Section that processes the needs of clients, which include crop water requirements, design criteria for hydrologists and engineers, and climatological information for resolving weather related legal and insurance issues.

2.9.4 The National Water Commission

The NWC is responsible for urban water supply throughout the island and is the largest provider of sewerage services. The NWC also has responsibility for many of the parish water systems and supplies 75 percent of the population with potable water. It is the principal implementing agency responsible for water resources development in the non-agricultural sector.

The NWC is a statutory body created in 1980 under the National Water Commission Act, Section 4(1) of the Act states that the functions of the NWC are as follows:

- Prepare and submit to the Minister from time to time proposals for the establishment of an efficient, co-ordinated and economical water supply system capable of meeting the needs for water throughout the Island;

- Prepare and submit for approval of the Minister details of schemes for the development of water resources and the supply of water in particular areas, and to carry out such schemes when they are approved;

- Keep under constant review the quality, reliability and availability of water supply services as a whole and the rates charged for such services and advise the Minister on these and any other matters relating to water supplies in the Island which may be referred to the Commission by the Minister;

- Within the limits of its resources provide and improve water supply services throughout the island.

The NWC has in recent years set itself the goal of operating in a more efficient manner, but still within the wider economic and social objectives of the GoJ.

The National Water Commission has a mandate to provide potable water and waste water services to Jamaican communities except those small rural communities that are the responsibilities of the parish councils. It is also responsible for urban sewerage systems.

The work of the NWC is backed up by a well-established legal framework and it has a fairly sound reputation for monitoring the quality and levels of ground water which accounts for 84 percent of available water and 92 percent of all water used in the

island (Karanjac, 2005). (The NWC monitors water quality for its own purposes, the WRA and NEPA also monitor water quality for regulatory purposes.) However, PAHO raised concerns about the ratio of sampling to population served and the different standards used by the parishes (PAHO, 2004). These concerns are of particular importance in view of the geographical structure of most of the island. These concerns are of particular importance in view of the geological structure of most of the island. Some of the problems of this organization stem for limited financial resources. Infrastructure has failed to keep pace with population growth. Some of the pipes are more than 60 years old. They are rusty, they leak and are blocked over many parts of the system (Neufville, 2002). Replacement is using up a large part of the budget and resources of the Commission. The Commission must find additional sources of water for the KMA. Experts say that if all the city were connected to a working and environmentally friendly sewerage system, water sources would be protected and large amounts of water in aquifers that are polluted at present would be recovered. In 2002, 24 percent of households were connected to sewerage systems (Neufville, 2002), but by 2010, this number had increased to 47% (UNEP-CEP, 2010).

Most of these agencies already work together on sub committees of the National Disaster Committee which, under the National Disaster Action Plan, is responsible for disaster policy. A flood warning system involving the Meteorological Office, the Water Resources Authority and Office of Disaster Preparedness and Emergency Management (ODPEM) exists and this association has allowed the incorporation of flood warnings into community preparedness activities. There is an automatic (real time) warning system and community operated warning systems covering vulnerable communities. Information is relayed to ODPEM when a critical level is reached and response teams at the community level make decisions as to whether evacuation to emergency shelters is necessary.

In addition, a great deal of research has been done in the area of hazard risk assessment in the island. Flood plain maps exist for river systems and multihazard assessments for the Kingston Metropolitan Area have been undertaken. These document vulnerability to seismic events, landslides and coastal storm surges (Ahmad and McCalpin, 1999). In addition, the Caribbean Disaster Mitigation Project undertook a study to estimate storm effects in the Caribbean Basin and the storm hazard maps of Jamaica focus on key areas of vulnerability – Montego Bay where there is intense shoreline development associated with the tourist industry; Kingston, the capital and major port; Port Esquivel, an oil terminus on a shallow bay and Rocky Point a railway and bauxite terminal on a shallow bay (OAS, 2000).

There are also international organizations involved in emergency preparedness and response. UNICEF, for example, in response to its mandate to protect disadvantaged children supports the activities of ODPEM in the wake of disasters, supplying food, shelter and emergency kits.

As a result there is a relatively high level of preparedness for disasters. ECLAC and IDB (2007) have pointed to several areas where improvements are necessary – community preparedness, increase in emergency stocks, emergency water supplies, improvement in community shelters. But as important as these initiatives may be they cover just one aspect of the preparedness and they are not sufficiently focused on people and the health impacts of the hazard. A similar structure but one that is more inclusive, that is capable of providing a response to the broader health implications of climate change, such as increased periods of drought, and saline intrusion into coastal aquifers, is necessary.

2.9.5 The Water Resources Authority

The first organized programme for the systematic collection of stream flow data was initiated by the Water Resources Section of the Public Works Department in 1954. The Water Resources Division was established in 1965, when the Water Resources Section was transferred to the Geological Survey Department in connection with the United Nations Development Programme (UNDP) and Food and Agriculture Organization (FAO) project which was completed in 1973. On completion of the UNDP/FAO project, the Water Resources Division of the Ministry of Mining and Natural Resources continued to monitor surface and groundwater island-wide. Between 1979 and 1984, the Water Resources Division was transferred to the Ministries of Local Government, Agriculture, and Public Utilities.

The WRA is responsible for the management, protection, and controlled allocation and use of Jamaica's surface and underground water resources. This responsibility will be achieved through the development and administration of a long term comprehensive Water Resources Development Master Plan for Jamaica. The latest update in this long term planning process is currently being finalised. This document seeks to become the main decision making tool for the Government of Jamaica (GoJ) and enable rational decision making on current and future water use and allocation, providing economic and environmentally sound development options.

The Water Resources Act of 1995 requires that on matters of water resources development and quality, the WRA consult with and provide technical advice and information to, and co-ordinate development with several other agencies of the GoJ, including the NWC, NIC, Ministry of Health, Commissioner of Mines, National Environment and Planning Agency, National Works Agency, Parish Councils and others.

The Water Resources Authority has undertaken a wide range of climate change activities including rainwater harvesting across the island.

2.9.6 The National Irrigation Commission

The NIC is responsible for the development of agricultural water supply sources and for the operational aspects of the production and distribution. It was incorporated under the Companies Act in 1986. The primary goals of the NIC are to increase productivity and profitability in the agricultural sector and to achieve and maintain financial self-sustenance of the irrigation industry.

The NIC was commissioned by the GoJ to prepare a National Irrigation Development Plan (NIDP). This plan was produced in 1998. The Master Plan of the NIDP assessed the current and potential state of the irrigated agricultural sector, the constraints and deficiencies facing the sector and proposed policy, and the strategy and development plans to relieve the constraints and overcome the deficiencies within the sector.

Approximately 25,000ha or 10% of cultivated lands in Jamaica are currently irrigated, while the NIDP estimated the potential irrigable areas to be over 90,000ha. The NIDP is scheduled for implementation over a 17-year period (until the year 2015). Over 120 projects were identified, of which 51 projects are proposed for implementation, with 27 of them recommended for implementation during the first 5 years of the plan.

2.9.7 NGOs and Community Groups

NGOs' and community groups' participation is key to mainstreaming climate change and ensuring "buy-in", and government should encourage their involvement in climate change responses.

3 KEY SECTORS AND ASSOCIATED LEGISLATION AND REGULATIONS, POLICIES AND PLANS

3.1 Agriculture

The Intergovernmental Panel on Climate Change (IPCC) has reported that agriculture is responsible for over a quarter of total global greenhouse gas emissions. Given that agriculture's share in global gross domestic product (GDP) is about 4 percent, these figures suggest that agriculture is highly Green House Gas intensive. Innovative agricultural productivity remains low; poverty, vulnerability and food insecurity remain high; and the direct effects of climate change are expected to be especially harsh. Creating the necessary agricultural technologies and harnessing them to enable developing countries to adapt their agricultural systems to changing climate will require innovations in policy and institutions as well. In this context, institutions and policies are important at multiple scales.

In Jamaica, although the contribution of agriculture to GDP has been declining, it is still central to the Jamaican economy for employment and foreign exchange earnings. Climate variability is already affecting the sector with declines in the agricultural production index being associated with hurricanes and drought.

3.1.1 Impact of Agriculture on Climate Change

The agricultural sector is a driving force in the gas emissions and land use effects thought to contribute to climate change. In addition to being a significant user of land and consumer of fossil fuel, agriculture contributes directly to greenhouse gas emissions through practices such as rice production and the raising of livestock; according to the IPCC, the three main causes of the increase in greenhouse gases observed over the past 250 years have been fossil fuels, land use, and agriculture.

Agriculture contributes to greenhouse gas increases through land use in four main ways:

- CO_2 releases linked to deforestation;
- Methane releases from rice cultivation;
- Methane releases from enteric fermentation in cattle;
- Nitrous oxide releases from fertilizer application

Together, these agricultural processes comprise 54% of methane emissions, roughly 80% of nitrous oxide emissions, and vitally all carbon dioxide emissions tied to land use.

Deforestation affects regional carbon reuptake, which can result in increased concentrations of CO_2, the dominant greenhouse gas. Land-clearing methods such as slash and burn compound these effects by burning biomatter, which directly releases greenhouse gases and particulate matters such as soot into the air.

3.1.2 Agricultural Land Use Policy

The Agricultural Land Use Policy (AGLUP) calls for, among other things, adopting climate change farming techniques, and choices, and to explore accessible and affordable insurance and mitigation techniques to ensure sustainable farming. Climate change and its effects on agricultural production and productivity will be documented and stored in the MoAF's Data Bank, and RADA will undertake adaptation and mitigation measures. Crop resilience to climate change studies will be conducted and the information used to assist farmers in adaptation techniques and crop choices to encourage optimal land use.

Pages 17 – 18 of the AGLUP contains a summary of the possible effects of climate change and its impact on agriculture.

The policy also addresses subdivision of prime agricultural lands for non-farm uses, and the denudation of land in the upper watersheds due to improper farming methods.

3.1.3 Plant Health Policy (Green Paper)

The policy seeks to address the gaps and failures in the current plant health system in light of requirements of international treaties and agreements of which Jamaica is signatory and food safety and phytosanitary standards of our major trading partners. The policy identifies issues faced by Government that hinder the development of an efficient plant health system. The policy makes provision for the revision of existing legislation, building of institutional capacity, scientific systems, quarantine capacity, surveillance systems, emergency response for pest outbreaks and increased public awareness.

General goals of the plant health policy are to:

- Improve the current plant health system in accordance with international standards and obligations;

- Harmonize national plant health legislative, regulatory and institutional frameworks;
- Facilitate the development of systems that mitigate the introduction and spread of harmful alien pest species;
- Promote the use of sustainable integrated pest management strategies in order to reduce the dependence on pesticides by farmers, thus enhancing food quality;
- Protect the natural environment from the harmful impact of invasive plant pests; and
- Increase public awareness and role of stakeholders in protecting plant health.

However, while the Policy recognizes changes in climate as a potential effect on the ecosystem of plant pests and invasive alien species, it does not address the effects of expected climate change on plants and plant health, or climate change as a factor for enhancing the spread of plant pests. Neither are climate change adaptation and/or mitigation strategies considered. It does however suggest that government create a Plant Health Board to provide advice on plant health, and a National Emergency Plant Pest Committee which will coordinate the response to pest incursions and outbreaks, and suggests that the government finalize the Emergency Action Plan for exotic plant pests and diseases that details actions to be taken in the event of a pest or disease outbreak. Climate change adaptation and/or mitigation could be included in the mandate of the Plant Health Board. A National Emergency Plant Pest Committee would be vital for coordination of response to pest incursions and outbreaks, and for the Emergency Action Plan, not only exotic plant pests should be considered but also local pests which could become problematic due to climate change.

3.1.4 Draft Organic Policy

This policy covers organic food production, farming systems and trade. It will address accreditation of certification bodies, development of national organic standards and legislation that will govern the production and trade of organic food. It will also address Government's role in marketing, research and development and the provision of extension and other services to the organic sub-sector. Capacity building among farmers and extension officers will also be addressed by this policy. The policy also outlines the key institutions through which it will be implemented. Organic farming is more environmentally sustainable and contributes to food security, both of which are important in adaptation to and mitigation against the effects of climate change.

3.1.4.1 Guiding Principles of the Policy

The principles guiding the policy are as follows:

- **Private sector-led industry** with Government playing a facilitatory role;
- **Socio-economic development** with emphasis on enhancing rural development;
- **Competitiveness** is central to the development and sustenance of the industry;
- **Food Security-** Organic agriculture contributes to increased availability and accessibility of food;
- **Food Safety** - Organic food should not endanger consumers' health; and
- **Environmental sustainability**- Organic agriculture promotes ecological balance and mitigates against the adverse effects of climate change.

3.1.5 Comparison with Recommendations Made in Jamaica's Second National Communication to the UNFCCC

None of the above policies address the recommendations made in Jamaica's Second National Communication (JSNC) to the UNFCCC:

- Leverage and co-ordinate international funding to maximize benefits within the Agricultural sector.
- Improve access to loan/grant funding to domestic crop producers.
- Raise awareness of the potential impact of climate change on the agricultural sector. Climate change is not mentioned in the Agricultural Development Strategy 2005-2008.
- Develop modelling approaches and tools to allow assessment of impacts of climate change on export and domestic crops and meat production. Detailed crop/country/ climate specific assessments are required to inform an adaptation programme and policy development.
- Review approaches to integrated cropping and management systems under climate change.
- Develop regional links to fund and promote plant breeding programmes for common crops. Adaptation strategies include the development of crop varieties with increased temperature, drought and pest resistance.
- Review approaches to integrated pest management under climate change. Existing pest management strategies may require modification under climate change. Care must be taken that any changes to these strategies do not have negative impacts on the environment, for example, from increased pesticide use.
- Support and fund increased water use efficiency across irrigated agriculture
- Support & expand funding of the IWCAM programme as well as internationally hosted coastal zone management and other related initiatives.
- Initiate Climate Change Working Group for Agriculture.

- Review role of financial instruments to provide insurance protection to key sub-sectors.

3.2 Food security

"Climate change merely increases the urgency of reforming trade policies to ensure that global food security needs are met" said C. Bellmann, ICTSD Programmes Director. An ICTSD-IPC study by Jodie Keane suggests that climate change could cause farm output in sub-Saharan Africa to decrease by 12 percent by 2080 although in some African countries this figure could be as much as 60 percent, with agricultural exports declining by up to one fifth in others. Adapting to climate change could cost the agricultural sector $14bn globally a year, the study finds.

IPCC Fourth Assessment Report also describes the impact of climate change on food security. Easterling *et al*. (2007) looked at studies that made quantitative projections of climate change impacts on food security. It was noted that these projections were highly uncertain and had limitations. However, the assessed studies suggested a number of fairly robust findings. The first was that climate change would likely increase the number of people at risk of hunger compared with reference scenarios with no climate change. Projected climate change impacts were projected to be smaller compared to the impact of social and economic development. In 2006, the global estimate for the number of people undernourished was 820 million. Under the Special Report on Emissions Scenarios (SRES) A1, B1 and B2 scenarios, projections for the year 2080 showed a reduction in the number of people undernourished of about 560-700 million people, with a global total of undernourished people of 100-240 million in 2080. By contrast, the SRES A2 scenarios showed only a small decrease in the risk of hunger from the 2006 level. The smaller reduction under A2 was attributed to the higher projected future population level in this scenario.

3.2.1 Food and Nutrition Security Policy – Work in Progress (WIP)

The broad goal of the Food and Nutrition Policy (WIP) is to ensure that all Jamaicans, at all times, have physical and economic access to sufficient safe and nutrition food to meet their dietary needs and food infrastructure and food preferences for an active life.

A Food and Nutrition Security Plan is important for Jamaica in order to address the country's main food and nutrition problems. Goal 7 of the Agriculture Sector Plan seeks to ensure National Food Security. In order to ensure National Food Security, there will be increased access to adequate and safe food supplies for the population; increased domestic production and improved nutritional status of the population through consumption of healthy foods.

The national food and nutrition security policy is an integral part of the National Agriculture Policy and National Development Strategy and aims at addressing the threats and opportunities relating to food security in the country.

The food security policy of Jamaica must address the country's critical food and nutrition problems and must also provide a framework of food security in line with the internationally accepted definition of food security, *viz*, "Food security is achieved when all people, at all times, have physical and economic access to sufficient safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" World Summit Meeting, 1996).

The Policy addresses the following issues:

- Production and productivity in the agricultural sector;
- Nutrition status of the population;
- Social protection and domestic food supply stability;
- Climate change;
- Vulnerable groups

In respect to climate change the Policy states:

In addition to the severity of damages caused by natural hazards, the phenomenon of global climate change thus poses a major threat to the stability of domestic food supplies. The agriculture and fisheries sectors are vulnerable to natural hazards which have significantly damaged the livelihood of the producers and dislocation to domestic food supply.

Total damage and loss to the agricultural and food processing sectors from floods, tropical storms and hurricanes for the period 2002-2010 amounted to J$23.4 billion, with damage mainly being on crops, livestock, infrastructure, etc. Much of these losses are borne by producers, especially the small and vulnerable and Government, which plays a critical role in the rehabilitation efforts in the sector. It is therefore critical that mitigation strategies be developed to help reduce the impact of natural hazards and adaptation strategies and programmes be implemented to assist in building resilience to the evolving threat of climate change.

Key Concerns

Population growth – the government must ensure that food productivity can contribute to the food security needs of a larger population in line with demographic

trends while factoring in the carbon footprint due to Green House Gas (GHG) emission from increased production.

3.3 Coastal Zone

The IPCC Fourth Assessment Report (2007) reports that global sea level is expected to rise between 18 and 59 cm by the end of this century, not accounting for changes in ice flows in Antarctica and Greenland, which could boost that figure. Local rates of sea level change depend not only on the overall global warming and ice melt, but on regional changes in ocean and wind circulation patterns. With strong growth in coastal populations worldwide, sea level rise has strong and direct impacts on low-lying areas through increased coastal flooding and erosion, contamination of groundwater supplies, and increased vulnerability to storm surges.

Figure 1. Beach Front Houses Destroyed by Hurricane Ivan Storm Surge on Caribbean Terrace

Sea level rise will lead to reduced area available for mariculture and aquaculture. Changes to estuaries' ecosystems, salt water infusion have the tendency to influence shift in species abundance, distribution and composition of fish stocks. In some coastal areas, damage to freshwater capture fisheries and reduced freshwater availability for aquaculture and a shift to brackish water species could be negatively predicted. Loss of coastal forest ecosystem will alter the ecosystem balance between the riparian and freshwater interaction.

The coastal zone is critical for Jamaica and a number of technologies for adaptation have been suggested to aid in improving coastal zone management and hence reduce the overall vulnerability of the coast to sea level rise. While it was noted that beach protection measures such as groynes and revetments will be required, the reinstating of the tidal gauge network so as to get data was highlighted as a priority. This reinstating of the tidal gauge network should be coupled with improved data collection for the geographic information system. Beach profiling needs to be expanded in Jamaica to aid the improved data collection. The regeneration of mangroves has also been highlighted as a priority. Data collection also needs to be improved along with an improvement in the current geographic information systems. Improvement in the geographic information systems will aid in planning and project designs, thus ensuring that vulnerability reduction will occur.

There is a need for an improvement and rationalization of the hydrometric network. There is a need for additional river gauges and more automatic weather stations to aid in data collection

and planning to reduce vulnerability. There is also the need for additional flood warning systems. Additional software such as waterware, riverware, and mikebasin are also required to aid in the improvement of water management in Jamaica.

Coral reefs are likely to experience adverse effects from a range of climate change related events such as increases in sea-water temperature, sea-level rise, changes in storm patterns, changes in rainfall patterns, and additional pressures from nearby cities and settlements (Watson *et al*., 1996). Although coral reefs can recover from brief episodes of warmer water, prolonged periods (greater than 6 months) of increases in seawater temperature result in irreversible bleaching (Brown and Suharsono, 1990). Coral reefs are an integral part of the island ecosystem. For example, during the 1982/83 EI Nino event, sea surface temperatures in the Caribbean exceeded 29°C, which led to extensive coral bleaching throughout the Caribbean. The coral reef surrounding Jamaica experienced several stresses that eventually resulted in the total collapse of the coral reef. These stresses included previous overharvesting of the reef fish (which clean the reef of unwanted algae and detritus), widespread coral bleaching, the proliferation of algal populations associated with waste runoff from the island, and the simultaneous disease and die-off of the sea urchins that normally clean the bottom of the reef and remove macroalgae (Lessios *et al*., 1984). The entire island ecosystem was affected and the reefs and fish populations still haven't recovered, resulting in extended losses in food, tourism and the economy (Epstein *et al*., 1998).

In summary, Jamaica's climate in the 2080s is likely to have the following features if greenhouse gas emissions continue to increase.

- Winds: overall there will be more winds;
- Rainfall: there is likely to be more average rainfall;
- Temperature: there will be higher mean temperatures. Surface seawater temperatures in inshore waters and estuaries will also rise, but not quite to the same extent as air temperatures, due to the moderating and lag effect of a slower rise in ocean temperatures;
- Storms and extreme events: estimates of likely changes in regional climate extremes are even less certain than projections of average conditions;
- Sea-level rise:

Sea-level rise in itself will obviously cause many of the impacts unique to coastal margins, but other drivers affected by climate change – such as river flows, winds, waves, storm intensity and perhaps frequency – will create their own impacts besides exaggerating or mitigating the impacts of sea-level rise. For coastal and estuarine aquatic ecosystems, changes in water temperature – caused by changes in ocean

currents, winds, upwelling, and air temperature – will cause biological impacts of similar significance to the physical changes caused by sea-level rise.

The most serious physical impacts of climate change on coastal margins will be:

- Coastal inundation, causing landward displacement of estuaries, wetlands and marshes;

- Coastal erosion and shoreline change through sediment movement;

- Increased vulnerability to coastal storm damage and episodic flooding;

- Surface water, river water and groundwater in lowlands becoming increasingly saltier from seawater intrusion.

A rising mean sea level will initially cause more frequent coastal flooding of peripheral areas of coastal margins by extreme tides and storm surge. Even if storm frequency and intensity remain similar to present-day levels and tides are unchanged, an overall rise in the mean sea level will substantially increase the probability of a given land mark or level being exceeded, and hence causing more damage to housing and infrastructure.

Pressures on our coastal areas

- There are huge pressures to develop and occupy the coast (for subdivisions, marinas, roads and drainage). Beach-front property prices continue to escalate in most beach resorts;

- At vulnerable coastal margins, coastal development and global warming are on an eventual collision course (if they have not collided already), which will result in further 'coastal squeeze' between the land and the sea;

- Developed areas around the Jamaica coast are usually nestled in or near low-lying coastal margins, such as beaches, estuaries and harbours, and will therefore become increasingly vulnerable to the effects of global warming.

3.3.1 Expected Impacts on Coastal Margins

- Parts of the coastline have historically been eroding or retreating, and climate change will exacerbate these trends;

- Sea-level rise will eventually lead to permanent inundation of very low-lying margins, episodic sea flooding of higher margins, increased coastal erosion,

salinisation of adjacent freshwater, drainage problems in adjacent low-lying areas, and further coastal squeeze where shorelines are held and constrained by structures such as seawalls and stopbanks;

- Climate change will affect not just sea-level rise, but most physical drivers that shape coastal margins and ecosystems, such as winds, storms, sediment supply sea temperature;

- Predicting shoreline response as a result of climate change is complex, and simpler conceptual models based solely on sea-level rise are of limited use. Beach response will also depend on factors such as sediment supply, wave climate, storm, frequency and alongshore changes in sediment movement;

- Wind and wave changes will alter sediment movement and coastal upwelling of cooler nutrient-rich oceans waters, which are important for coastal productivity, including fisheries;

- Increase in storm rainfall intensities will lead to lowland river flooding and impacts on water quality from increased sediment loads to estuaries, although sediment availability will also depend on catchment land-use and construction practices;

- Aquatic ecosystems will be affected by rising temperatures (air and water), potential loss of habitat in some areas, and increases in sediment loads entering estuaries during storms in other areas;

Most existing coastal erosion hazard problems result from development being too close to the sea to accommodate the natural cycles of cut-back and advance of the shoreline. There is little doubt that global warming impacts will exacerbate these same problems in the long term through sea-level rise and other climatic changes which impact on the coastal margin.

3.3.2 Ocean and Coastal Zone Management Policy

The five Policy goals of the Ocean an d Coastal Zone Management Policy are:

1. Promotion of Sustainable Development
2. Conservation of Ocean and Coastal Resources and Ecosystems
3. Baseline data Collection and research
4. Using the role of science to transform Ecological knowledge of Integrated Coastal Area Management
5. Proving the conditions of management required for effective integrated Coastal Area Management

The policy is to provide a comprehensive framework for the management and development of resources in Jamaica's ocean and coastal zones. A National Council on Ocean and Coastal Zone Management was established in 1998 to coordinate the policy and is guided by terms of reference which include measures to develop an integrated marine policy for Jamaica. There are no immediate plans to update this policy.

Currently, the Council is seeking to develop policies in relation to Cays Management and the use of Jet Skis on the island's coastal and inland waterways.

3.3.3 Mangrove and Coastal Wetlands Protection - Draft Policy and Regulations

The document reviews the issues affecting wetlands in Jamaica as well as the Government's role and responsibility. Five main goals are outlined. These are guidelines for wetland development, cessation of destructive activities, maintenance of natural diversity, maintenance of wetland function and values and integration of wetland functions in planning and development. This policy, along with the Coral Reef Protection and Preservation Policy will be subsumed into a **National Coastal Resources Policy** which will be finalized mid-2012/13 financial year. Presumably, the new policy will incorporate climate change considerations, in keeping with NEPA's Climate Change Response Strategy.

3.3.4 National Policy for the Conservation of Seagrasses (1996)

This policy recognizes the value of seagrasses to marine ecosystems and seeks to regulate and guide the issuing of licenses, or permits for activities such as dredging, disposal of dredge spoil, beach development and effluent disposal, which directly or indirectly affect seagrass communities. This policy is currently being reviewed.

3.3.5 Towards A Beach Policy for Jamaica (A policy for the Use of the Foreshore and the Floor of the Sea) November 2000 (Draft).

Though the policy specifically addresses the controversial issue of beach access, it addresses issues relating to oil pollution, sewage pollution, solid waste disposal, beach erosion (a climate change concern), coastal water quality, mariculture and wild life protection. Oil Pollution is to be addressed by the National Oil Spill Emergency Plan administered by the Office of Disaster Preparedness and Emergency management, The Jamaica Defense Force and the Natural Resources Conservation Authority. Sewage Pollution may be addressed by the development of community based disposal systems for example aeration ponds and polishing beds. Any system developed should ensure that effluents are discharged at points, which will result in minimal or no effect on the coastal zone. The proposed Solid waste management Act will now address solid waste disposal. Beach Erosion is oftentimes the result of illegal sand mining and public

education and general law enforcement may address illegal sand mining. With reference to Wildlife Protection, the document acknowledges that many of Jamaica's beaches and offshore cays are nesting sites for turtles, sea birds and other animals, some of which are endangered. The policy therefore proposes that measures be implemented to prevent or reduce any threat to wildlife and their habitats.

The policy has in Appendix II, an extract from "Evaluation of Coastal Hazards" April, 2000 – A Collaborative Project of the H. John Heinz III Centre for Science, Economics and the Environment, which states, "However, the forecasted rates of sea level rise are based on highly uncertain assumptions …. Tide gauge records show no statistically significant evidence suggesting global warming has accelerated sea level rise over the past 100 years (Douglas, 1992; Houghton *et al.*, 1996). Short-term variations in sea level that endure for a decade or more can distort evidence of sea level rise acceleration." From this it appears that at the time the policy was prepared, sea-level rise was not thought to be conclusive.

This policy is currently being reviewed.

3.3.6 Coral Reef Protection and Preservation Policy

To improve the protection of coral reefs and by so doing sustain their ecological and socio-economic functions.

The policy recognizes that coral reefs are among the earth's most biologically diverse, oldest and species rich ecosystems. The aim of this policy is to ensure the conservation of coral reefs in order to sustain their ecological and socio-economic functions. It proposes to achieve this aim by (a) reducing the quantity of pollutants being released to the coastal environment (b) reversing the trend of over fishing by more stringent regulation of the fishing industry (c) reducing the physical damage to reefs as a result of recreational boating, souvenir hunting, spear fishing, dynamiting and other activities; (d) improving the response capability for addressing oil and other chemical spills; and (e) regulating coastal zone development which contributes to coral reef destruction and or degradation. The implementation of the policy is to be guided by given principles. These include an integrated coastal zone management approach to ensure an acceptable balance between conservation and development objectives; a co-management approach and public education.

This policy, along with the Mangrove and Coastal Wetlands - Draft Policy and Regulations will be subsumed into a **National Coastal Resources Policy** which will be finalized mid-2012/13 financial year. Presumably, the new policy will incorporate climate change considerations, in keeping with NEPA's Climate Change Response Strategy.

3.3.7 NRCA Guidelines for the Deployment of Benthic Structures (1996)

These guidelines cover the definition of benthic structures, site selection, environmental impacts related to structure deployment and licensing requirements. There are no immediate plans to update these guidelines.

3.3.8 NRCA Guidelines for Development in the Coastal Zone in Jamaica (1998)

This document serves as a guide for actions to be taken and the relevant agencies to be consulted for development in the coastal zone. It gives an idea of potential environmental impacts resulting from certain development activities and guides mitigation measures; and reviews the requirements for permits, licenses and environmental impact assessments.

There are no immediate plans to update these guidelines.

3.3.9 NRCA Guidelines Pertaining to Marinas and Small Craft Harbours

These guidelines focus on the environmental aspects of marinas and small craft harbors and are aimed at those responsible for site selection, the design, construction and operation of marinas. The objectives are to enable the establishment of berthing areas for small craft while preserving coastal resources and beauty.

There are no immediate plans to update these guidelines.

3.3.10 NRCA Guidelines for the Planning, Construction and Maintenance of Facilities for Enhancement and Protection of Shorelines

These guidelines offer guidance on the permitting process, environmental aspects and coastal engineering planning and design of projects related to protection and enhancement of shorelines.

There are no immediate plans to update these guidelines.

3.3.11 The Natural Resources Conservation (Portland Bight Protected Area) Regulations 2000 (Draft)

These draft regulations seek to regulate certain activities with the Portland Bight for application within the area declared to be the Portland Bight Protected Area, and applies in addition to any other regulations relating to the said area. Regulations cover aspects such as beaches, fisheries, protected species and developments.

There are plans to promulgate these regulations but no date has been determined.

3.3.12 Beach Control Act, 1956

The Beach Control Act regulates rights to the foreshore and the floor of the sea in Jamaican waters. Provisions contained in the Act govern commercial and recreational activities; the control and management of development on the beach through licensing provisions and the protection of the marine ecosystem. Marine protected areas may be declared under the Act to:

- Control the disposal of rubbish or other waste matter;
- Control dredging or disturbance in any way of the floor of the sea;
- Prevent or control the destruction or removal of sea fans and sedimentary marine animals; and
- Control the searching for or removal of any treasure or artifact from the floor of the sea.

This Beach Control Act is limited in its mandate to govern development and commercial activities on the foreshore and floor of the sea, and does not appropriately address larger issues of the proper management of the coastal zone and marine resources.

This Act was promulgated in 1956 and vests all rights in and over the foreshore and the floor of the sea in the crown. Any use of these areas except for rights acquired under the act is subject to a license from the Natural Resources Conservation Authority, which is the body now, administering the Act. Though this Act is dated, there is provision for protected areas. Section 7 grants the Minister discretionary power to declare, upon the recommendation of the Natural Resources Conservation Authority, any part of the foreshore or the floor of the sea together with the water lying on such part of the floor of the sea to be a protected area. The purposes for protection though somewhat limited but useful. The activities listed are: fishing by any means; the use of boats, other than boats propelled by wind or oars; the disposal of rubbish or any other waste matter; water skiing, the dredging or disturbance in any way of the sea floor; the destruction or removal of coral, sea fans and sedentary marine animals and the searching for or removal of any treasure or artifact from the floor of the sea. The Act also provides for the declaration of public bathing beaches and procedures relating to public rights of access.

The fines will be amended in the 2012/13 financial year.

3.3.13 Port Authority Act, 1972

The Port Authority Act is responsible under the Act for the development and regulation of port facilities which include structures for the safe navigation, berthing and loading and off-loading of cargo. Dredging, construction and reclamation of coastal land are activities carried out by the Port Authority pursuant to its statutory functions.

3.3.14 The Morant and Pedro Cays Act, 1904

The Morant and Pedro Cays Act establishes licensing conditions for these offshore cays and; prohibits unauthorized fishing and the removal of birds and turtles, and their eggs.

3.3.15 The Harbours Act, 1976

The Harbours Act provides for the declaration of the harbors in Jamaica, and the appointment of a harbor master with general authority to regulate the safe movement of vessels within the harbor limits and to maintain aids to navigation. The Act makes the discharge of noxious matter from vessel into the harbor a criminal offence. The Harbours Act authorizes the Port Authority to declare, establish or alter the boundaries of harbors.

The Port Authority has ultimate management responsibility for all harbors in the island.

3.3.16 The Maritime Areas Act, 1996

The Maritime Act replaced the Territorial Seas Act, which originally established for Jamaica a 12-mile territorial sea. The Maritime Act declares Jamaica to be an archipelagic state and merely defines the various maritime zones. The Act however may be defined as a framework within which the Minister may, subject to his regulatory powers under Section 28, create more substantive provisions to carry out the true intent of the Act.

There is no provision that currently specifically addresses the conservation of marine resources, though the regulatory provisions provide that the Minister may make regulations for the preservation and protection of the marine environment and the prevention and control of marine pollution; and the conservation of living resources in the internal waters, archipelagic waters, territorial sea, contiguous zone and continental shelf.

3.3.17 Comparison with Recommendations Made in Jamaica's Second National Communication to the UNFCCC

None of the policies, guidelines or acts address the recommendations made in the JSNC which are:

- Thorough revision of the present published setback guidelines;
- Re-engineering of the Mandela Highway and other arterial roads at low elevation to make them all-weather highways;
- Warning system for heavily populated and tourist areas of the coastline for events such as tsunamis, flash floods, accidental release of poisonous gases, oil spills etc.;
- Beach nourishment projects for carbonate beaches;
- Research to:
    - determine an estimation of vulnerability to storms and sea-level rise for the entire island. This should include island-wide re-leveling to determine the position of local sea-level at various places around the island;
    - Perfect setback guidelines for ICZM;
    - Identify offshore carbonate sand deposits for beach nourishment;
    - Expand the programme of co-operatives for fisher-folk;
    - Monitor, using satellite images, the changes in the health of the island's coastal ecosystems.

3.4 Climate Change and Disaster Resilience

Jamaica like all other small island developing states (SIDS) is also exposed to the impacts of multiple hazards associated with global climate change (GCC). Global climate change has been described as the "most serious threat to sustainable development facing CARICOM states" (CCCCC, 2009), and in that regard the CARICOM Heads of State at a meeting in 2007 requested that the Caribbean Community Climate Change Centre (CCCCC) prepare a *Framework For Achieving Development Resilient To Climate Change.* This strategy, prepared for the period 2009-2015, provides a roadmap for action over the period 2009-2015.

The IPCC indicated that the projected impacts of global climate change on the Caribbean region are expected to be devastating. Rising sea levels, together with the associated coastal erosion and salt water intrusion, an escalation in the frequency and intensity of tropical storms and hurricanes, and disruptions in rainfall and fresh-water supply threaten the viability of CARICOM countries.

Scientists in Jamaica have determined that sections of the coastline are already experiencing the effects of sea level rise. Accelerated erosion has been occurring along some coastal segments and although the contributory factors may be varied, the results indicate areas where sea level rise has increased vulnerability. The economic heartbeat and population concentrations lie along the coast, so adaptation measures are imperative. Increasingly variable weather patterns have accentuated flood-drought cycles with implications for water availability. Food security issues loom large when unavailability of water affects agricultural production and contributes to fires which from time to time destroy hundreds of hectares of produce, as well as vegetation cover on unstable slopes. Mitigation efforts are required of all nations under the UN Framework Convention on Climate Change (UNFCCC), but it is adaptation strategies that need to be fully

implemented in Jamaica so as to build resilience at the community as well as national levels in Jamaica.

3.4.1 The National Hazard Mitigation Policy and National Response Matrix

The National Hazard Mitigation Policy and National Response Matrix prepared in 2005, is a significant step toward disaster risk reduction, but the policy has not been widely disseminated, and no action plan has been developed for its implementation.
The main goals of the Policy have been stated as:

i. The acceleration of the attainment of sustainable development objectives through hazard mitigation;

ii. The minimization of physical, economic and social dislocations through hazard mitigation strategies.

Five (5) major policy objectives have been identified and agreed on:

(i) To provide an integrated legislative, regulatory and institutional framework in support of hazard mitigation at all levels of society;

(ii) To reduce environmental, social and economic dislocations, with emphasis on infrastructure, land use practices and rehabilitation of degraded areas;

(iii) To promote collaboration and coordination among national, regional and international agencies in order to harmonize activities towards achieving common hazard mitigation objectives;

(iv) To empower communities to manage hazard risk;

(v) To protect and rehabilitate the natural, social and economic environments through hazard mitigation.

3.4.2 The Office of Disaster Preparedness and Emergency Management Act (1998)

This Act established the Office of Disaster Preparedness and Emergency Management (ODPEM) to develop and implement policies and programs to achieve and maintain an appropriate state of national and sectoral preparedness for coping with emergency situations. Under the Act disaster is defined to mean A the occurrence or threat of occurrence of an event caused by an act of God or otherwise, which results or threatens to result in *inter alia,* damage to property, damage to the environment on a scale which requires emergency intervention by the state. Disaster preparedness includes an activity undertaken in anticipation of a disaster, hazard or

other emergency situation. Though this Act is very general in its application, the Office of Disaster Preparedness and Emergency Management in conjunction with the Natural Resources Conservation Authority has formulated guidelines for disaster relief and response pursuant to. Jamaica is a member of the Caribbean Island Oil Pollution Preparedness Response and Co-operation Plan. This is a tiered response procedure designed to assist island states and territories within the region with oil pollution incidents that are beyond their capacities.

The Act of 1993 is the current law under which ODPEM executes its disaster management mandate. The law provided for the renaming of the disaster agency to Office of Disaster Preparedness and Emergency Management (ODPEM). According to Section 4 of the Act, ODPEM the Organization is mandated:

> "... *to advance disaster preparedness and emergency management measures* in *Jamaica by facilitating and coordinating the development and implementation of integrated management systems".*

3.4.3 Disaster Management Act 2009 (Draft)

The draft Disaster Management Act is geared towards strengthening areas in need of immediate attention. These include the need for:

- legal recognition of existing organizational structures such as the National Disaster Committee, the Parish Disaster Committees and the Zonal Committees, with their roles and functions clearly established;
- legal establishment of a National Disaster Fund;
- legal evacuation of persons identified to be at risk as a prevention measure;
- identification and description of high-risk areas as "specifically vulnerable areas" and the necessary action to be taken in respect of such areas;
- Acceptance of the current Revised Law with some modification;
- The Disaster Council (now recognized by law);
- The Board for ODPEM as a Statutory Body;
- An Executive Director and Staff;
- Parish Disaster Committee Structure

The Draft provides for flexibility in terms of operational structure and staffing. Of interest are the modalities of evacuation which relate to total evacuation, and Especially Vulnerable

Areas. However, the evacuation order is not compulsory.

3.5 Education

There is need for education about the unique consequences of global warming for coastal margins. A better informed public should engender a growing acceptance of these consequences and assist buy-in to prudent response options at the local level. There should be capacity building of institutions through the training of scientis ts to monitor climate change in various fields.

The Ministry of Education plans to include climate change in the curriculum of primary schools starting with the 2012/2013 school year.

3.6 Fisheries

Fisheries and aquaculture are threatened by changes in the earth atmosphere and ocean, such as increasing global surface temperature, rising sea levels, increases in incident UV radiation, irregular changes in average annual precipitation, and increases in the variability and intensity of extreme weather events. Greater climate variability will complicate the task of identifying impact pathways and areas of vulnerability requiring research to devise and promote coping strategies and improve the adaptability of fishers and aquaculturists especially in the developing countries. Many coastal and island communities where poverty is widespread and livelihood alternatives are limited depend heavily on fish resources for their well-being. Fish also provides an important source of cash income for many poor households.

The majority of the full and part-time fisherfolk (fishers, fish processors, traders and ancillary workers) and their dependents live in areas vulnerable to human-induced climate change, or depend for a major part of their livelihood on resources whose distribution and productivity are known to be influenced by climate variation. However, relationships between the biophysical impacts of climate change and the livelihood vulnerability of poor fishing communities have seldom been investigated. Information has been lacking on the areas and people that are likely to be most vulnerable to climate-induced changes in the fisheries. This information is required for the effective prioritisation of development interventions to reduce vulnerability to the impacts of adverse climate change on fisherfolk living in poverty. The fisheries sector makes important contributions to local development in coastal areas, through employment and multiplier effects. Maintaining or enhancing the benefits of fisheries in the context of a changing climate regime is an important development challenge.

According to Nurse (2009), the vulnerability of any sector to climate change is a function of the
(a) degree of exposure to the threat
(b) sector's sensitivity to the risk and
(c) capacity of the sector to cope with or adapt to the threat. Exposure and sensitivity to climate

change are high in the Caribbean small-scale fisheries, while adaptive capacity is low (FAO, 2005; Salas *et al*., 2007). Among the reasons for this conclusion are:

i) Observed and projected negative impacts (direct and indirect) on the sector, e.g. through habitat and ecosystem damage, e.g. bleaching of corals, additional stress on mangroves and seagrasses;

ii) Linkage between ocean warming as a triggering mechanism in the proliferation of harmful algal blooms and various diseases;

iii) Dependence of fisher folk on sector for employment, revenue generation and human well-being;

iv) In the Caribbean many fisher folk tend to reside in vulnerable, low-lying coastal areas which exposes their physical assets (e.g. boats, gear, homes) to climate-related events such as hurricanes, storm surge and sea-level rise;

v) While the sector has demonstrated considerable resilience to climate variability in the past, factors such as lack of consistent governmental, access to capital on reasonable terms, weak fisher folk organizations and consequently low bargaining
power will compromise adaptation capacity in the future;

vi) Lack of insurance and other institutional support to enable the sector to rebound in the aftermath of extreme events, which are projected to become more frequent and/or intense in the future.

While the list of factors presented above is not exhaustive, it provides a reasonable indication of the issues confronting the fisheries sector in the Caribbean. Since it is widely anticipated that climate change will amplify these challenges, appropriate and timely interventions will be required in order to minimize the adverse effects on stakeholders. The following actions can be taken to improve the resilience of habitats and targeted species to the adverse effect of climate change.

i) Strict enforcement of existing marine pollution control protocols and abatement of contamination from land-based sources,

ii) Reactivation and expansion of habitat protection and restoration programmes, and

iii) Control of non-sustainable practices such as overharvesting, and the use of inappropriate harvesting methods.

Since it is likely that climate change will impact negatively on the future availability of stocks, an overriding direct concern for fishers is the extent to which alternative forms of employment

(seasonal or otherwise) can be pursued as an adaptation option. The pursuit of alternatives would help to compensate for expected reductions in revenues and livelihood support caused by climate change. However, it would require the intervention and assistance of Government and the Private sector, working in close collaboration with the fishing community and affiliates. In this regard, organizations such as fisheries cooperatives could play a significant role in assisting with the creation and sourcing of opportunities, as well as the 'retooling' of fishers with new skills.

3.6.1 Draft Mariculture Policy

The aim of the draft Mariculture Policy is to support and encourage the managed use of the nation's marine resources to raise output of marine food products for domestic consumption and for export, and to generate local employment in communities that have traditionally relied upon the sea. In order to achieve this broad aim government will pursue three main goals: (1) establish the principles for carrying out sustainable mariculture. (2) end or effectively control potentially damaging practices associated with mariculture. (3) promote the recognition of mariculture as an option for the sustainable use of coastal resources.

In pursuing these goals, the government will be guided by the following principles:

- The culture of local species is preferred, but under controlled circumstances introduction of species may be allowed.
- Sustainable mariculture can only be achieved through the coordination of functions of the relevant government agencies, and close collaboration with mariculture operatives and their communities.
- Public awareness of the importance of the role of mariculture in preservation of marine species, and the need for good environmental quality must be improved.

The policy statement is made in support of achieving the stated goals. Specifically, the policy seeks to:

- Establish designated areas for Mariculture;
- Exercise greater control over Mariculture operations;
- Develop the economic potential of Mariculture and in particular Oyster Culture;
- Protect mariculture operations from pollution;

- Protect the environment from the harmful effects of mariculture by requiring an Environmental Impact Assessment for the mariculture operations;

- Increase public awareness of the benefits of mariculture as an alternative or supplement to the capture fishery, and as a useful tool for species management.

The Draft Policy sees mariculture as an opportunity to provide a sustainable supplement or an alternative to marine capture fishery. The need for an alternative arises due to the fact that uncontrolled harvesting of fish, pollution, and the destruction of mangroves and coastal wetlands has severely depleted shellfish stocks, especially the mangrove oyster. The policy therefore aims to support and encourage the managed use of the nation's marine resources, to raise the output of marine food products for domestic consumption and for export, and to generate local employment in communities that have traditionally relied on the sea for economic sustainability. The policy is consistent with the government's development objectives, and is expected to be carried out within the framework of an integrated coastal zone management (ICZM) plan for Jamaica.

3.6.2 Draft Fisheries Policy

3.6.2.1 Status

Fisheries has drafted a new Fisheries Policy which will be consistent with acceptable principles of sustainable development. The Fisheries Policy will have as its main goals the following:

1. Contribute to economic growth and reduction of poverty;

2. Contribute to sustainable livelihood of Jamaicans through employment in fisheries and related activities;

3. Contribute to the provision of Food security

The immediate objectives are (Fisheries Division pers. comm.):

1. Ensure sustainable development of the fisheries industry;

2. Promote efficiency of the fishing industry;

3. Promote economic and social development of fisheries industry;

4. Improve systems and procedures for the management of the fishing industry

5. Promote partnerships with stakeholders in the management of fisheries and ensure transparency and accountability in the governance of fisheries resources.

6. Comply with international standards and best practices for fisheries development and management in keeping with Jamaica's commitments under various agreements and conventions.

The main elements of the Fisheries Policy are:

3.6.2.2 Capture Fisheries

- Establishes a Fisheries Agency covering both commercial and sport fishers.

- Provides for a National Fisheries Advisory Council providing advice on fisheries management issues and facilitating stakeholder participation, and allows for Advisory Committees for each fishery.

- Provides for use of Fisheries Management Plans including objectives of management and strategies to be adopted, guiding numbers of licenses to be issued etc.

- Provides powers to Fishery Inspectors, and increases fines for fisheries offences, up to J$0.25 - 5m.

- Establishes lawful basis for use of catch quotas.

- Meets international obligations on authorisations for High Seas Fishing.

- Provides controls on foreign fishing inside Jamaican EEZ – in future foreign vessels will require licenses under access agreements and on payment of large fees.

3.6.2.3 Aquaculture

- Provides for preparation of Aquaculture Management Plans covering environmental, health and phyto-sanitary conditions.

- Establishes aquaculture management zones and buffer zones to minimize negative impacts of neighbouring activities.

- Requires farms to obtain aquaculture permits and to follow required conditions.

- Provides controls on importation of live fish to prevent introduction of diseases and avoid introduction of non-native species.

3.6.2.4 Management of Marine Capture Fisheries

The Final Draft National Fisheries Policy has clearly defined four zones that will be used to manage marine capture fisheries. The zones are (Fisheries Division pers. comm.):

- Zone 1: The island shelf surrounding the main island of Jamaica, including the slope down to 200 m adjacent to it;

- Zone 2: The Banks inside Jamaican waters down to 200m, except the Jamaica/Columbia Joint regime Area;

- Zone 3: The remainder of the EEZ of Jamaica, consisting of waters deeper than 200m;

- Zone 4: The Jamaica/Columbia Joint Regime Area;

- Any other zones that may be created.

3.6.3 The Fishing Industry Act, 1975

The taking and catching of fish are regulated by the Fishing Industry Act. A licence is required to catch fish utilizing one of the prescribed methods under the Act.

The Act provides for the protection of fish through the designation of fish sanctuaries and the declaration of open and closed fishing seasons (for conch and lobster). Two Fish Sanctuaries have been declared under this Act.

Regulations are being created for the management of the conch fishery. For the lobster fishery, the Act stipulates the size of lobsters to be caught and mesh size for nets. The fines under this Act are extremely low ranging from one hundred to one thousand Jamaican dollars.

3.6.4 Draft Fisheries Bill

A Fisheries Bill has already been drafted to replace the Fishing Industry Act (1975); the 1976 Regulations; sections of the Wild Life Protection Act dealing with fish; and the Morant and Pedro Cays dealing with fish; and the Morant and Pedro Cays Act. The Morant and Pedro Cays Act provide a licensing system for fishing and prohibit the killing of turtles and birds on the Cays.

The Fisheries Bill is related to the regulation of the fishing industry and serves to conserve and manage the fisheries resources by addressing issues such as licensing of fishers. It also gives the Minister the power to make regulations with respect to use of fishing equipment, methods of fishing, marketing of fish, management and control of fishing beaches and measures for conservation of fish. A comprehensive approach to fisheries management is to be reflected in the proposed new Fisheries Bill.

The Bill addresses fishery management plans, declaration of fishery management areas around the island and the establishment and operation of aquaculture facilities. It will also include provisions for conservation and management measures and licensing of all fishing activities to ensure enforcement of the controls. This Bill is currently being reviewed.

3.7 Forestry

The National Forestry Agency (NFA, formerly the Forestry Department) recognizes that climate change could have major impacts on the distribution and abundance of forest-dwelling species, the proliferation of pests and diseases, and destruction of forests by storms and other extreme climatic events and is revising its Forest Policy to include climate change considerations.

3.7.1 Forest Policy 2001

The Forest Policy sets out in the first section, the primary goals and priorities pertaining to the conservation and protection of forests and the sustainable management of forested lands and watersheds. The second section deals with strategies and tools for implementation of these goals, including community participation, the promotion and regulation of forest industries, forest research, public education and forestry training, incentives, funding, and monitoring. The third section outlines the mandates and roles of the Government agencies involved in forest land management (including changes effective April 1, 2001). Updates relative to the 1996 Policy Statement reflect legislative, institutional and other developments that have occurred since 1996, and public input received during the development of the National Forest Management and Conservation Plan.

The Forest Policy is being revised and a new Draft Forest Policy 2012 has been developed. In this Draft, some priority areas of the previous policy have been retained, but additional/new areas for reform of the Forest Act 1996 have been added, and new objectives and measures have to been identified, e.g. improvement of the legal and institutional framework for development, management and conservation of all forests in Jamaica; expansion of the jurisdiction of the Agency to facilitate protection and conservation of trees, forests and mangroves on private lands in rural and urban areas. The new Forest Policy will *inter alia* adopt the precautionary approach in relation to decisions taken that will directly or indirectly affect forests, and will recognize the value of forest lands goods and services. Under the new Forest Policy, ownership of Forest Reserves will be transferred from the Commissioner of Lands to the National Forest Agency (NFA) on a phased basis. The NFA will create LFMCs for each Forest Reserve and will adopt co-management agreements for forests designated as community forests, and *inter alia* strengthen the rights and responsibilities of LFMCs to regulate access and use of forest resources. The NFA will be promoting carbon credits as a means of preserving forests while generating income and some projects that will be undertaken from carbon trading are reforestation and afforestation.

3.7.2 National Forest Management and Conservation Plan (NFMCP)

The Forestry Department's management and conservation activities are essential components to meeting the objectives of the Rio Conventions by (Forestry Department, 2001):

- Reducing the rate of biodiversity loss (CBD);
- Maintaining and measuring the role of forests as carbon sinks (UNFCCC);
- Prevention of land degradation and drought (UNCCD).

Jamaica is an active member of the United Nations Forum on Forests (UNFF) and along with other UNFF members has agreed on four shared global objectives on forests to (Forestry Department, 2001):

- Reverse the loss of forest cover worldwide through sustainable forest management (SFM), including protection, restoration, afforestation and reforestation, and increased efforts to prevent forest degradation;
- Enhance forest-based economic, social and environmental benefits, including by improving the livelihoods of forest-dependent people;

- Increase significantly the area of sustainably managed forests, including protected forests, and increase the proportion of forest products derived from sustainably managed forests; and;

- Reverse the decline in official development assistance for sustainable forest management and mobilize significantly-increased new and additional financial resources from all sources for the implementation of sustainable forest management.

The above objectives are included in the National Forest Management and Conservation Plan (NFMCP) which is based on four broad values to society: environment; national wealth and rural development; energy; and recreation and tourism (Forestry Department, 2001). The goals are to (Forestry Department, 2001):

- Protect the forest resource;

- Restore tree cover;

- Conserve biodiversity;

- Improve the economic contribution of forests to the well-being of the Jamaican people;

- Produce fuelwood on a sustainable basis;

- Maintain the visual quality of forests;

- Enhance the use of forests for recreation and tourism;

- **Increased participation of communities**, placing those people most affected by, or dependent on, forests at the centre of forestry development;

- Strong leadership and organizational management achieved by transformation of the Forestry Department as already initiated under the Public Sector Modernization Vision and Strategy;

- The practice of sustainable forest management, balancing economic, social and environmental values;

- Fostering rural development whilst improving the quality of life for all Jamaicans;

- Providing opportunities for equitable participation in the management, conservation and enjoyment of forests;

- Building partnerships between government, private sector and non-government organizations (NGOs) based on shared goals and values.

Increased participation of communities is one of the strongest strategies for the implementation of the NFMCP by the Forestry Department, and the Forestry Department plans to increase the number of Local Forest Management Committees (LFMCs) to 12 by 2013 (Brown and Bennett, 2010). If this target is achieved then 12 of the 26 watersheds will be managed by LFMCs (Brown and Bennett, 2010).

LFMCs have been key in (Brown and Bennett, 2010):

- reducing pressure on forest resources and
- reducing illegal activity particularly unauthorized logging – but not by a formal role in enforcement or patrolling – in the forest reserves
- promoting environmental education and stewardship, awareness and outreach

3.7.3 Strategic Forest Management Plan

The Strategic Forest Management Plan is a result of the review of the NFMCP by the Conservator of Forests. The review revealed that, "while the **fundamentals** of the Plan **were still applicable**, **amendments and a renewed focus were required for the implementation of the strategies"** (7).

"This conclusion led to the adoption of a strategic planning approach that involved:

• Systematic prioritization of efforts and activities that will lead to the achievement of the Forestry Department's mission and goal;
• Identification of strategies that:
o State what must change to achieve the organization's objectives;
o Establish an order for activities;
o Are aligned to achieve strategic objectives;
o Provide communication and direction;
o Allow everyone to pull together in a focused manner;
• Performance reporting based on measures that are SMART i.e:
  - *Specific;*
  - *Measurable;*
  - *Accountable;*
  - *Results-orientated;*
  - *Time-bound.*

Application of these principles resulted in identification of the prioritized objectives, desired outcomes, performance measures, targets and strategies" (7). The strategic objectives for the five years are (Forestry Department, 2010):

- Build the Forestry Department as an efficient and effective service delivery organization
- Increase participation of the private sector and non-government organizations.
- Increase community participation and public awareness
- Develop and implement forest management plans
- Maintain and restore forest cover

The 2010-2015 Strategic Forest Management Plan states that over the next five years, local forest management plans will be developed, approved and implemented for at least 50% of the national area designated as Forest Reserves or Forest Management Areas.

3.7.4 The Forest Act, 1996

The Forest Act is the only piece of legislation in Jamaica that uses the word 'biodiversity'. This Act sets out the role and function of the Forestry Department and the Conservator of Forests.

The Act vests responsibility in the Conservator of Forests for developing and maintaining an inventory of forests and lands suitable for the development of forests.

The Forestry Department is required to make an assessment of forestry lands to determine their potential for maintaining and enhancing biodiversity. Provisions have been made in the Act for the controlled utilization of forest resources in a rational manner.

Jamaica has over 100 gazetted forest reserves. Under the Act private lands may be acquired for declaration as forest reserves. One of the purposes of forest reserves is to protect and conserve endemic flora and fauna.

The Act calls for the creation of forest management plans, which stipulate the allowable annual cut where appropriate, conservation and protection measures and the roles of other Government departments. The purpose of forest management plans is to ensure the protection and conservation of forests, soil, water, wildlife, and forest products.

The Act makes it an offence to: destroy trees, cause damage, light fires, carry axes, kill or injure wild birds or animals in a forest reserve or forest management area.

Currently, the Forest Act, 1996 is under revision.

3.7.5 Forest Regulations, 2001

Under regulation 4 a forest management plan shall contain the following particulars:

- Maps showing the boundary of each forest estate and the surrounding community catchment;

- The location of any dams, water supply intakes and other infrastructure;

- Maps and schedules describing the size, shape and location of land or block of land (i) required to be reforested and (ii) suitable for harvesting during the period of the plan.

- Silocultural plans and prescriptions for the land to which the plan relates and the natural forest reserve;

- Protection of wildlife, water and soil.

In preparing each forest management plan the Conservator shall consult with government agencies and other relevant groups and thereafter submit the plan to the Minister for approval.

The Forest Regulations -

(1) Regulate the use of forest roads;

(2) Prohibits the use of an open fire or charcoal except in compliance with a burning permit

(3) Regulates cattle trespass in a forest estate, protected area or forest management area

(4) Provides for saw mills licences and permits.

The Forest Regulations makes provision for the establishment of community catchment areas.

By regulation 41 except as directed in writing by the Conservator or an approved forest management plan each waterway, stream, river or wetland shall be deemed to have a buffer zone of a minimum of 20 metres from the river bank within which zone

no person shall (a) operate any equipment; or (b) cut, fell or remove any forest produce.

Under regulation 46 the Conservator shall encourage and promote the preparation and adherence to management plans for the protection of forest and forestry activities on private landholdings. Any private land that is declared as a forest estate, forest management area or protected area shall be managed in accordance with a management plan.

3.8 Health

Climate is one of several contributing factors influencing the incidence of infectious diseases. Other important considerations include factors such as human migration and transportation; drug resistance and nutrition; environmental influences such as deforestation; agricultural development; and urbanization (Chen *et al*., 2008).

Infectious diseases may be classified broadly into two categories based on the mode of transmission:

- those that spread directly from person to person (direct contact or droplet exposure) and
- those that spread indirectly through an intervening vector organism e.g. mosquito, or a non-biological physical vehicle e.g. water.

Infectious diseases also may be classified by their natural reservoir as anthroponoses (human reservoir) or zoonoses (animal reservoir). Climate influences the temperature and fluid levels of both the infectious agent and the associated vector organism directly due to their small size and lack of thermostatic mechanisms. There is therefore a limited range of climatic conditions within which each infectious agent or vector organism can survive and reproduce. Other climatic variables to which infectious agents, vectors and hosts are sensitive include amount of precipitation, wind and duration of sunlight. Climate changes as well as biotic factors, such as human intervention, vegetation, host species, will therefore affect the distribution and abundance of vector organisms and intermediate hosts (Chen *et al*., 2008).

Various integrated modeling studies have shown that an increase in ambient temperature could cause worldwide, net increases in the geographical distribution of particular vector organisms as well as potentially increase the transmission of vector-borne diseases due to changes in the life-cycle dynamics of both the vector and the pathogen (Chen *et al*., 2008).

Based on recent studies of disease variations associated with inter-annual climate variability, higher temperatures, changes in precipitation and climate variability would for the most part extend geographical range and seasonality of transmission of

many vector-borne diseases, although it could be reduced in some cases (Chen *et al*., 2008).

Variability in precipitation has direct consequences on infectious disease outbreaks. Increased precipitation may increase the presence of disease vectors by (Chen *et al*., 2008):

- expanding the size of existent larval habitats and creating new breeding grounds.
- supporting a growth in food supplies which in turn supports a greater population of vertebrate reservoirs.

Flood rains may decrease vector populations by eliminating larval habitats and creating unsuitable environments for vertebrate reservoirs or, may force insect or rodent vectors to seek refuge in houses and increase the likelihood of vector-human contact, e.g. outbreaks of leptospirosis, a rodent-borne disease, after severe flooding (Chen *et al*., 2008). In times of drought, storage of water in containers, such as uncovered drums, create suitable habitats for the breeding of mosquitoes (Chadee *et al.*, 2009). In addition, heavy rains can cause contamination of watersheds by human and animal faecal products and other wastes resulting in outbreaks of diseases like typhoid, amoebiasis, cryptosporidiosis, and giardiasis (Atherholt *et al*., 1998; Curriero *et al.*, 2001).

Improved access to primary health care in Jamaica has resulted in an increase in life expectancy at birth from 70.5 years in 1980 to 73.1 in 2011 (Jamaica Met Service, 2011; UNDP, 2011). However, some of the gains are being reversed under the impact of the HIV/AIDS epidemic, unintentional and intentional injuries (Jamaica Met Service, 2011).

Jamaica is at the point in the epidemiological transition in which, while non-communicable diseases are the leading causes of death, the health system must still cope with infectious and parasitic diseases as well as rising levels of HIV/AIDS and intentional and unintentional injuries. A high incidence of cerebrovascular diseases increases susceptible to heat stress but this is considered to be of greater importance in cold than in hot countries. This problem, however, could be exacerbated by the construction material used and the design of housing. Buildings need to be designed to reduce heat stress and vector-borne diseases (Chen *et al*., 2008).

Of the respiratory conditions, asthma is a cause for concern. Rising carbon dioxide levels could increase allergenic plant pollens. Increasing quantities of dust clouds containing minute particles and microbes are blown into the Caribbean from the Sahel region of Africa. The African/American atmospheric system is a long standing phenomenon. However, human activity in the expanding desert region of Africa has intensified the problem and dust concentrations in the Caribbean are correlated with rainfall deficits in the Sahel. Climate change and increasing drought could therefore have a significant effect on the concentration of dust. Researchers in Trinidad and

Tobago report a correlation between paediatric admissions for asthma and increasing Sahara dust cover (Gyan *et al*., 2005; McCarthy, 2001). Asthma-related visits to health care institutions in Jamaica comprised 6.3 percent of all visits and a prevalence study is being conducted to provide crucial data on its prevalence ("Asthma", 2006).

The health of the population can be affected if there is too much or too little water. The conditions can facilitate the spread of water and vector borne diseases such as malaria, dengue, cholera and leptospirosis. Increasing temperatures and rainfall events and or more droughts can lead to an increase in the severity and frequency of dengue fever outbreaks.

Climate change, acting via less direct mechanisms, would affect the transmission of many infectious diseases (especially water, food, vector-borne and rodent-borne diseases) and regional food productivity (especially cereal grains). In the longer term, these indirect impacts are likely to have greater magnitude than the more direct (McMichael *et al*., 2001 and Epstein, 1999). Other illnesses, such as mental stress, could also indirectly be impacted by climate change.

3.8.1 National Health Policy

The National Health Policy 2005-2015 and the accompanying Strategic Plan 2006-2010 is prepared within the framework of the Medium Term Socioeconomic policy and the philosophy (The Manifesto); international and regional health and development guidelines and other related national plans. The policy/planning process was participatory with extensive stakeholder consultation and discussion to obtain consensus on a broad range of health related issues. The gaps and challenges of the Ministry of Health Strategic Plan 2001-2005 were also identified in the process. It is therefore expected that there will be harmonization with other sectoral policies and plans that seek to achieve national development as well as ownership, responsibility and accountability for the outcomes of the plan, by stakeholders.

In keeping with GOJ Strategic/Corporate Planning methodologies and processes, the plan is outcome oriented. Thus, the priorities and performance indicators are coherently and clearly enunciated to facilitate monitoring and evaluation as well as modification of operational plans. This National Health Policy and Strategic Plan is predicated on 1999 and 2002 data and trends. The latter is therefore the base year against which evaluation should be done.

The possible impact of climate change on health is not specifically mentioned although this is of increasing international concern. However, surveillance of internationally notifiable, nationally monitored, as well as newly emerging and re-emerging diseases are mentioned as goals. Emerging and re-emerging diseases are considered a consequence of the ecological changes associated with climate change

and the unsustainable use of resources. So there is some recognition in the Plan, though not explicit, of the likely effects of climate change.

Moreover, in response to the threat of emerging and re-emerging diseases as well as the anticipated changes in vector borne diseases, the MOH prepared a national vector control plan with the goal of re-establishing a Vector Control Unit in the Ministry (Chen *et al.*, 2008). The plan makes proposals for financing in the areas of staffing, procurement of supplies, adaptation of new technologies and strategies for vector control, the strengthening of surveillance systems and the improvement of inter-sectoral, inter-agency capacities and research (Chen *et al.*, 2008). An emergency plan is also being developed within a unit with specific responsibilities for health emergencies (Chen *et al.*, 2008). However, much more needs to be done to prevent possible dangerous consequences of the direct and indirect impact of climate change on health, not just by the Ministry of Health but also by associated Ministries and Agencies whose functions impinge on the health of the nation.

One of the goals in Vision 2030, is for a healthy and stable population. There is an awareness of the importance of the state of the environment to the maintenance of a healthy population. There is also an acknowledgment that in much of Jamaica, there is improper disposal of all types of waste, and that there is increased atmospheric pollution from factories and motor vehicles. For the environment, the responsible agencies will be the Ministry of Health and the Environment, NEPA, MoAF, and the OPM.

The strategies that will be employed are (Jamaica PIOJ, 2009):

- Create appropriate frameworks to strengthen health security.

- Identify and assess the linkages between the health of Jamaicans and the state of the environment, and define appropriate long-term strategies to anticipate changing environmental conditions.

- Generate and sustain action across sectors to modify environmental determinants of health.

- Infuse climate change issues into health policy.

3.8.2 Comparison with Recommendations Made in Jamaica's Second National Communication to the UNFCCC

Some of the recommendations in JSNC to the UNFCCC are part of existing policies or plans, however, the following are not addressed:

- Inclusion of Climate Change in the Mandate of ODPEM;

- Public education in the management of stress, sanitation and food poisoning;
- Elimination of taxes on electric fans;
- Relevant agencies prepared for handling increases in the incidents of food poisoning;
- Suitable design standards for housing in areas subjected to high rainfall and hurricane winds, also methods to reduce heat absorption;
- More attention to be paid to the design of settlements;
- Improve the capabilities of ODPEM to warn of hazards;
- Improving data gathering ability and technical support staff of the Met. Service for monitoring and warning of air-borne diseases;
- More collaboration between research institutions involved in pollution control;
- Support should be given to research institutions involved in environmental related health risks to run as many regional and statistical downscaling models as possible for calibration and inter-comparison purposes;
- Safe water storage drums;
- More proactive actions in pressing the case for mitigation of greenhouse gases, especially by the developed countries, in order to prevent increased temperatures.

3.9 Housing and Human Settlements

Global climate change will have enormous impacts on urban areas in Jamaica. The known and growing effects of climate change – increased temperatures, rising seas, and increased incidence of severe storms – will be especially significant for cities such as Kingston, Montego Bay, Portmore and others due to the location of many along the coast, the population and capital assets at risk, and the important role of port cities in national economies.

Within cities and major towns in Jamaica, the poor are typically the most vulnerable. They tend to live in slum/informal settlements, often located in areas most exposed to the effects of global climate change, notably low-lying areas, steep slopes, and ravines. Reflecting the low and unstable incomes of the residents, but exacerbated by poor land tenure characteristics, little or no enforcement of building regulations, and the inadequacy of housing finance, housing quality is low and provides poor resistance to natural disasters. The inherent vulnerability of these settlements is amplified as the effects of global climate change become more pronounced.

Sustaining and improving human settlements in the face of ongoing global climate change should become an important lens for Jamaican cities and towns as they look to the future. Areas where the poor live will pose special challenges. Adapting to climate change will require many cities and towns to substantially improve their capacity in precisely those areas where past deficiencies have resulted in the proliferation of informal settlements. These include land using planning and regulation, effective infrastructure investment, and legal and administrative systems

that can support the development of efficient land markets and tenure arrangements. Government will need to wrestle with complicated issues as they try to adapt to climate change impacts at the local level - equity in public expenditures; collaboration with private investors; the authority, role and capacity of local governments; and incorporating much long-range projections into plans and investments, to name a few.

Adapting to global climate change will impose large costs on cities and towns, particularly low-lying coastal cities and towns such as Kingston, Montego Bay and Portmore and others. While the bulk of these resources will need to come from private sources, donors have an important role to play in supporting the science and the development of effective practices and methodologies for countries to employ in policy and program formulation.

3.9.1 National Land Policy (1997)

The goals and objectives of this Policy are to ensure the sustainable, productive and equitable development, use and management of the country's natural resources.

The Policy also aims to compliment socioeconomic development initiatives of the country. It challenges and seeks to remove inefficient, onerous and outdated legal, administrative, management and other barriers that affect the planning, use, control, development, protection and conservation of Jamaica's physical resources.

3.9.2 National Spatial Plan

A national spatial unit has been established within the Ministry of Water, Land, Environment and Climate Change to work with all relevant Government agencies to develop various aspects of a National Spatial Plan which was first promulgated by the MoAF. The National Spatial Plan will:

1. Rationalize the use of local land resources through the preparation of a National Physical Plan to:

    i) Specify broad spatial planning objectives and guiding principles for national and regional development;

    ii) optimize the use of land and natural resources by providing a framework for making sustainable locational choices;

iii) Improve governmental capacity to formulate, coordinate and implement integrated rural development policies and programmes in order to address spatially unbalanced development.

2. Set a national context for spatial planning at the local level.

3. Inform strategic infrastructure policy and public investment decisions which support the achievement of balanced regional development, by taking account of and highlighting the relationship between infrastructure and the economy, patterns of development within it, and quality of life.

4. Strengthen inter-sectoral coordination of the country's development within a spatial framework and provide the private sector with a clear context of Governmental investment decisions and commitments.

The environmental related reasons for the development of a new spatial plan are (National Spatial Plan):

- The most recent National Physical Plan is dated and is in need of updating, specifically to:
  a. reflect changes in the use of the nation's land resources;

  b. reflect the objectives of Vision 2030 Jamaica and provide the basis for prioritizing and rationalizing land dependent decisions;

  c. provide the framework for integrated planning;

  d. anticipate changes in the international environment, including the impact of globalization on land use in Jamaica;

  e. Integrate hazard risk management issues into and use rationalization;

  f. Provide an updated hierarchy of population centres;

  g. Assess and present spatial requirements for the industrial sector, identifying opportunities and required skill sets;

  h. Revise projected land requirement for specific uses (industry, housing, conservation, transport and other infrastructure);

  i. Re-assess the development and distribution of social amenities;

  j. Assess the effects of Government investment decisions e.g. 'new towns' development and infrastructure including highways.

- Provide institutional framework to facilitate better coordination of decision-making;

- Spatial planning needs to play a more effective role in the development process. Jamaica's vision and goal of achieving global competitiveness and developed country status by 2030, hinges heavily on its capacity to pursue planned and orderly development and to sustainably manage its natural and environmental resources.

- Population is projected to reach 3.3 million by 2030 but the urban population will grow at a much faster pace. Currently growth in this segment has coincided with an outward expansion of urban centres resulting in some instances in the conversion of agricultural lands – potentially impacting the country's food and water supply. Much of this growth has taken place in an uncontrolled manner and reflects inappropriate and unregulated land use. Settlements are important foci for diffusing development; the settlement strategy included in the National Spatial Plan will identify a hierarchy of centres to act as catalysts of development in specific areas.

3.9.3 Town and Country Planning Act, 1957 (Amended in 1999)

The Town and Country Planning (TCP) Act provides for the progressive and orderly development of land in order to improve and preserve the amenities of urban and rural areas. In Section 5 (2) of this legislation "development" is defined as;

> "the carrying out of building, engineering, mining or other operations in, on, over or under land or the making of any material change in the use of any building or other land".

Development orders prepared under Section 5(1) of the TCP Act provide guidance for the use of land. Planning permission is only required in areas for which a development order exists. Hence this Act is applicable only in areas where there is a development order. The order identifies the land zoning that is permitted in the defined area. Areas of agricultural significance are usually zoned for agricultural production. These applications are lodged at the Local Planning Authority i.e. the Kingston and St. Andrew Corporation and the parish councils.

Substantial amendments were made to the Town and Country Planning Act in 1999 to provide for effective enforcement. The Act is currently being revised to provide a more comprehensive control over planning in Jamaica.

The objective of the TCP Act is to ensure the orderly development of land. This is achieved through Development Orders which are legal documents used by the

planning authorities to *inter-alia* provide for protection of amenities and conservation and development of the resources of the prescribed area. Development Orders are the main means of control of land use in Jamaica by prescribing the type of development which may take place on land and require the grant of planning permission in the area where the order relates. The St. Ann Development Order of 2000 is the most recent Development Order. The Act speaks to preparing provisional development orders in relation to land whether or not there are any buildings on the land with the idea of controlling development, securing proper sanitation, roads, public services, protecting amenity and conserving and developing the resources of an area. The contents of a development order are set out in section 10 of the Act.

The old development orders do not take climate change considerations into account and need to be revised. However the significance of coastal areas is recognized by some of the orders e.g., Town & Country Planning (Hanover Parish) Coast.

The following are the existing Development Orders:

- Town and Country Planning (Bog Walk, Linstead, Ewarton Area) Provisional Development Order, 1964.

- Town and Country Planning (Clarendon Parish) Provisional Development Order (Confirmation Notification) 1982.

- Town and Country Planning (Filling Station Clarendon) Provisional Development Order (Confirmation Notification) 1994.

- Town and Country Planning (Hanover Parish – Coast) Provisional Development Order (Confirmation Notification) 1962.

- Town and Country Planning (Filling Station Hanover) Provisional Development Order (Confirmation Notification) 1962.

- Town and Country Planning (Kingston) Development Order, 1966.

- Town and Country Planning (Manchester Parish) Provisional Development Order (Confirmation Notification) 1984.

- Town and Country Planning (Portland Parish – Coast) Provisional Development Order (Confirmation Notification) 1963.

- Town and Country Planning (Spanish Town) Development Order, 1964.

- Town and Country Planning (St. Ann Parish) Provisional Development Order, 1999.

- Town and Country Planning (St. Catherine Coast) Provisional Development Order, 1964,

- Town and Country Planning (Filling Station, St. Catherine) Provisional Development Order (Confirmation Notification) 1964.

- Town and Country Planning (St. Elizabeth Parish) Provisional Development Order, 1976 (draft).

- Town and Country Planning (St. James Parish) Provisional Development Order (Confirmation Notification) 1982.

- Town and Country Planning (St. Mary – Coast) Provisional Development Order (Confirmation Notification) 1963.

- Town and Country Planning (Tinson Pen Harbour Front) Provisional Development Order, 1963.

- Town and Country Planning (Trelawny Parish) Provisional Development Order, 1980.

- Town and Country Planning (Westmoreland Parish) Provisional Development Order (confirmation Notification) 1978.

Presently the entire island is not covered by Development Orders. Existing orders are not updated regularly; however, NEPA has started the process of updating Development Orders and will include climate change considerations such as, setback for coastal areas. In areas covered by a Development Order, planning permission is required from the local authority or from the Town and Country Planning Authority if the area is "called in" or if the development does not conform to the zoning in the Development Order. In considering development applications the planning authorities take into account the Development Order and other material consideration.

NEPA currently has Draft Parish Development Orders for Kingston and St. Andrew, Portland, Trelawny, Manchester, St. James, St. Catherine (excluding Portmore) and St. Thomas. A draft order has been prepared for the Negril and Green Island Local Planning Area. The Clarendon Parish Development Order will be reviewed this year.

The Act also provides for the making of Tree Preservation Orders (Section 25) whereby a local authority may seek to preserve trees or woodlands in their area and prohibit willful damage or destruction of trees, or require the replanting of trees. The Act provides for notification of, designation, and the right to submit objections to the declaration of such an Order including provisions for compensation. These Orders are not widely used.

The Town and Country Planning Act is currently being revised.

3.9.4 The Town and Country Planning Coast Confirmed Development Orders

The intention of the orders is to make provision for the orderly development of the Island's coastline. The Orders are undoubtedly old, the first having been declared in 1959. The orders however do not place much emphasis on tourism development and the development of social amenities. There is therefore no mention of development in light of the conservation of marine resources. Later development orders however do reflect concern for marine resources. The Town and Country Planning (Trelawny Parish) Provisional Order 1980 addresses marine areas as one category that requires special planning considerations. The Order specifically addresses coastal erosion, pollution, and water borne effluent and mining, quarrying and sand deposits.

Under marine areas, the Order declares that severe coastal erosion and deleterious alteration to the marine environment by natural and artificial means requires the control of development which might affect the coast and coastal waters and to repair the damage which is now evident or imminent. It then refers to the need to effect coastal modification works like groynes in an effort to help build back the sand and protect inshore reefs.

In recognizing that pollution poses a serious problem to marine resources states that coast and coastal waters are to be protected against pollution by control of adjoining development. Development proposals are to be examined with regard to prevention or control of pollution. Careful monitoring of coastal waters is necessary for the cleanliness of the environment as a public health matter, and to maintain the high amenity of the inshore water used by increasingly greater numbers for recreation. This is particularly so where effluent might enter coastal waters by dumping or seepage. In addressing sand mining Section 10 of the order recognizes that though sand stealing is prevalent due to the absence of a natural supply of building sand elsewhere, it cannot be regarded as a source for extraction purposes. Since offshore sand deposits are not extensive and their rate of natural replenishment cannot compete with the current rate of removal, any extraction of any material constitutes development for which planning permission is required.

3.9.5 Land Development and Utilisation Act (1966)

The Land Development and Utilisation (LDU) Act seeks to retain agricultural land in agricultural use thereby preserving agricultural units and preventing properties with significant agricultural potential from being left undeveloped or underutilized. The Act establishes the Land Development and Utilisation Commission (LDUC) which has the responsibility to ensure that agricultural land is properly developed and utilised as far as possible and that occupiers of agricultural units fulfill their responsibilities to farm the agricultural lands in the units.

Idle land orders are served by the Commission on agricultural units where the agricultural lands in the unit are not being farmed to ensure that the occupier of the unit fulfils his/her the responsibility to farm the said agricultural lands. Provision is made under the LDU Act for the Minister, after receiving certification from the LDUC that an agricultural unit is not being satisfactorily utilized, to acquire the land compulsorily under the Land Acquisition Act in order to secure the continued use of the property for productive agricultural activity.

3.9.6 Parish Councils Building Act

Under the Parish Council Building Act the Parish Council of each parish (other than Kingston and St. Andrew) may make by-laws generally for regulating the erection, alternation and repair of buildings within the limits of and town or any rural areas of such parish. In relation to the parishes of Kingston and St. Andrew, the power to make by-laws may be exercised by the KSAC.

3.9.7 Local Improvements Act (1914)

The Local Improvements Act (LIA) provides for the subdivision of land. It requires the submission to the "Council" (Kingston and St Andrew Corporation and Parish Council of other parishes as defined in the Act) of a map of the land being subdivided that "shall be drawn to scale and shall set forth all such particulars as the Council may by regulations prescribe and especially exhibit, distinctly delineated, all streets and ways to be formed and laid out and also all lots into which the said land may be divided, marked with distinct numbers and shall also show the areas".

Section 14 (3) of the Act requires that the Council seeks the advice of the Government Town Planner (GTP) on the proposed subdivision. On receipt of the submission from the Council, the National Environment and Planning Agency on behalf of the GTP circulates the proposed subdivision to relevant government agencies for their comments. Depending on the factors including inter alia; the existing use of the land, its agricultural potential and the size of the property/lots, the proposal is forwarded to the Ministry of Agriculture for its comments.

The Government Town Planner in making a recommendation to the Corporation/Council on the

use of each lot in the subdivision incorporates the comments submitted by the government agencies as conditions for approval or reasons for refusal.

3.9.8 The Housing Act (1969)

The Housing Act of 1969 repealed the Housing Law of 1955. Under the Housing Act, the Minister of Housing is a Corporation Sole with powers to acquire, hold and dispose of land and other property. The Act also confers special powers on the Minister in relation to the approval and preparation of housing schemes.

The Minster is empowered to provide housing solutions (through the use of the Housing Fund) when the following scheme/areas are declared by the Minister:

Designated Housing Areas: the Minister has the responsibility for initiating and administering housing schemes where it is considered that there is a need for housing in an area. The process may involve the demolition of schemes and, if necessary, the compulsory acquisition of land, where the minister feels a scheme ought to be constructed.

Designated Slum Clearance Areas: where the houses in a particular area are by reason of disrepair, sanitary defects, etc are unfit for human habitation or are dangerous, and/or injurious to the health of the inhabitants, the Minister may designate such area a slum clearance area. In this instance the Minister is given vast, but necessary powers to clear the area and acquire the lands necessary for a complete urban redevelopment of the area.

Designation of Improvement Schemes: are applied where the Minister is of the opinion that the houses in a particular area are in a state of disrepair, badly arranged and/or overcrowded. Certain buildings may stand in the area that need not be demolished or there may be no necessity for total demolition. The Minister can serve notice upon the owners of these premises to put their houses in good order and if necessary prepare a scheme for the development of the area. If the owners fail to effect repair, the Minister can do so himself and charge the person.

Emergency Housing Schemes: this is where a public calamity has occurred or is expected to occur, as in the case of fire. The law gives the Minister the power of administering the schemes and also of acquiring the lands. The Minister has the same power and adopts the same procedure as that which exists in the Land Acquisition Act.

The Housing Act is significant to agricultural land use, as it relates to the acquisition of lands for the development, expansion or relocation of schemes. Sometimes, prime agricultural lands are designated as housing areas. On the other hand, the character of the land to be utilized may have changed significantly overtime due to population growth, expansion of the urban fence, etc. and so previously designated agricultural lands may become suitable to be utilized for housing. The soil capability of a particular piece of land may also have declined, so it is no longer suitable for agricultural production and since there is a great demand for housing than

3.9.9 The Land Authority Act (1951)

In 1951, the Land Authority Act was enacted, the goal of which was to encourage and secure proper and efficient utilization of all lands within specified areas where there was severe erosion and deterioration (Government of Jamaica, 1951). The establishment of an afforestation program under the 1963-1968 Five-Year Independence Plan followed next. The afforestation program outlined three categories of land use. These are:

- Areas which should be completely under forest cover;
- Areas which should be mainly under forest cover but in which there are pockets of cultivable lands;
- Areas which are predominantly cultivable but in which changes in control of land will be necessary.

3.9.10 Building Code

Jamaica's decades old Building Code has been replaced by a new National Building Code which will bring the country's construction practices in line with international standards while promoting safety the new Building Code which has been in development since 2003 comprises eleven application documents which will be used in conjunction with international codes developed by the International Code Council (ICC) tailored to suit Jamaican conditions. It will replace the older Building Code that was last updated in 1983 and which was previously based on the Building Code of 1908.

The Jamaican application documents comprising the new National Building Code incorporates residential, plumbing, energy conservation, private sewage disposal, property maintenance codes as well as existing building and international codes.

3.10 Tourism

The relation between climate change and tourism is twofold: climate change impacts on tourism and tourism's impact on climate change. The first relationship may ask for adaptation measures, like shifting destinations, seasons and activities and investing in new air conditioning systems. The second relation may ask for mitigation measures aimed at reducing greenhouse gas (GHG) emissions. Also mitigation policies in other sectors may have consequences for tourism as well and require also adaptation. An example may be measures aimed at reducing emissions by transport or the consumption of energy for heating or cooling accommodations. Such measures may change the cost of several

resources for the tourism industry, asking for adaptation measures and investments regarding activities, transport and destination choices. This section aims to give a short overview of the magnitude of the impact of tourism on climate change and some general remarks on mitigation and adaptation-to-mitigation.

For car transport, the backbone of tourism, options to reduce GHG emissions are increasing the energy efficiency, using bio-fuels or a combination of solar energy-hydrogen-fuel cells. These are all relatively expensive options that can only be realised in the medium long term. A complication is that other fuels generally lead to replacing the problems from the user phase to the production of the fuel (bio-fuels) or energy required to produce the fuel (hydrogen) or both.

Tourism can play a significant role in addressing climate change if the innovativeness and resources of this vital global economic sector are fully mobilized and oriented towards this goal. The concern of the tourism community regarding the challenge of climate change has visibly increased over the last five years. The World Tourism Organization (UNWTO) and several partner organizations, including UNEP, convened the First International Conference on Climate Change and Tourism in Djerba, Tunisia in 2003. This event was a watershed in terms of raising awareness about the implications of climate change within the international tourism community.

The Djerba Declaration recognized the complex inter-linkages between the tourism sector and climate change and established a framework for future research and policy making on adaptation and mitigation. A number of individual tourism industry associations and businesses have also shown leadership on climate change, voluntarily adopting GHG emission reduction targets, engaging in public education campaigns on climate change and supporting government climate change legislation.

The tourism industry and destinations are clearly sensitive to climate variability and change. Climate defines the length and quality of tourism seasons and plays a major role in destination choice and tourist spending. In many destinations tourism is closely linked with the natural environment. Climate affects a wide range of the environmental resources that are critical attractions for tourism, such as, wildlife productivity and biodiversity, water levels and quality. Climate also has an important influence on environmental conditions that can deter tourists, including infectious disease, wildfires, insect or water-borne pests (e.g., jellyfish, algae blooms), and extreme events such as tropical cyclones.

Jamaica's tourism product is dominated mainly by beach tourism with the main areas being the north coast areas of Montego Bay, Ocho Rios and Negril.

3.10.1 Master Plan for Sustainable Tourism Development

In 2003 Jamaica completed a Master Plan for Sustainable Tourism which called for the achievement of five main objectives, including:

- growth based on a sustainable market position;
- enhancement of visitor experience;
- community based development;
- an inclusive industry, and
- environmental sustainability

The framework of the Tourism Master Plan envisaged annual growth of 4% in visitor accommodation over the 10 year period from 2003-12, which would add over 10,000 rooms by 2012.

See section 4.1.3 for the Tourism Sector Plan in Vision 2030.

3.10.2 The Tourist Board Act (1955)

The general mandate of this Act is to develop all aspects of the tourist industry and to promote its efficiency, and to encourage measures for development of amenities to enhance the attractiveness of Jamaica to tourists. This Act is executed by the Jamaica Tourist Board.

3.10.3 Comparison with Recommendations Made in Jamaica's Second National Communication to the UNFCCC

Although the Tourism Master Plan had included infrastructural improvements like enlarged sewage treatment plants, the provision of affordable housing for hotel workers, this has not been realized. However, attempts have been made to vary the tourism product such as the promotion of community tourism. Proposed elements of a tourism adaptation strategy that have not been addressed are:

- Raise stakeholder awareness of the workings of both tourism and environment;
- Stakeholder identification of detailed programme and projects;
- Set up a comprehensive performance framework with targets;
- Reflect social and environmental costs in the price of tourism products;
- Improve environmental lobbying;
- Implement infrastructural changes to protect the environment, e.g., groynes and levees, reforestation, and coastal zone management;
- Implement education and sensitisation programmes;
- Increase urban tourism.

3.11 Water Sector Vulnerability: Issues and Threats

The water section in Jamaica is vulnerable to the existing climate and climatic variability. This can be seen with the impact of flooding events, either localized or

across large parts of the country linked with tropical storm events/hurricanes, as well as droughts related to global/regional climatic phenomena such as El Nino Southern Oscillation (ENSO).

The water sector includes quantity and quality of surface and ground water resources, as well as the water supply and wastewater systems and associated infrastructure. The role of land use and watershed management and protection, is critical to maintaining resilience of the sector.

The sector is vulnerable to a range of natural hazards as a consequence of a number of factors, which include:

- Location of Jamaica with respect to a) the paths of tropical storms/hurricanes, and the impacts of related storm surges along the coastline; and b) the Caribbean tectonic plate and its implications for earthquakes and tsunami.

- Geology and topography of Jamaica, which influence rainfall runoff, stream and karstic basin flooding, and landslides.

- Hydrostratigraphy of Jamaica which influence the location and extent of aquifers and aquicludes. With the spatial and temporal distribution of rainfall, these determine the spatial availability of water during drought periods.

Projected changes in Jamaican climate by the end of the century will result in the increased frequency and severity of dry spells/droughts, the increased intensity of tropical storm events/hurricanes, as well as a change in annual average climatic conditions with decreased annual average precipitation, increased evaporation and likely increased windspeeds.

To reduce the vulnerability of the water sector to these likely changes in climate requires the adoption of a proactive approach to both integrated watershed and water resources management. There are already a number of initiatives and plans/programmes in place that can form the core of this adaptation to climate change. These include the continuing work that is being undertaken by the Forestry Department through the implementation and continuing development of the National Forestry Plan.

Although flood hazard map do exist for a number of watershed, further modeling and mapping exercises are required to increase the coverage of these maps and the promotion of their existence to the relevant national and parish planning agencies and bodies. This is especially important with respect to the planning and location of key national assets given the likely range of sea level rise during this century coupled with tidal surges associated with tropical storms/hurricanes. Jamaica must develop a National Physical Plan for Jamaica which includes planning for Climate Change.

Planning is in place to develop a National Physical Plan but a National Spatial Plan has not yet been developed.

There is also a need to regularly review engineering design procedures to ensure that both existing and future structures such as bridge crossing and culverts have been designed and built with enough capacity to pass flood waters at agreed magnitudes.

Such an approach is conditional on the availability of hydrological/groundwater models that can be used to provide estimates of source yields under existing climate. Climate change impacts on yield estimates can then be assessed by perturbing inputs using results from the climate modeling studies. Therefore, there is a need for investment in the development of these models, which is conditional on the availability of the technical capacity within the relevant organisations and institutions. This is likely to require the pooling of available resources, both technical and financial, but does offer the opportunity of an agreed set of modeling approaches and tools across the key water sector stakeholders. These models can be used in both a planning as well as operational mode, using the outputs from climate models looking to the 2030s and beyond, and also shorter term predictions of likely climate in the next 1-2 years respectively.

At present, even without the modeling approaches suggested above, support for measures to increase water use efficiency must continue. This is both for the agricultural sector as well as for public water supply.

Monitoring is a key aspect to understanding what is happening within the watershed. Therefore, investment in the meteorological/hydrological/hydrogeological monitoring networks must be a priority. This includes quantity as well as quality. It is important that a co-ordinated approach across agencies is adopted to maximize return on this investment and avoid duplication of effort. It is also important that the collected data, once it has been through the necessary Quality Assurance/Quality Control checks is made available to all stakeholders. The WRA has a GIS web-based database system that can be accessed through its website that provides an existing platform for stakeholders to view and download these kinds of data. The continued investment and growth of this service must be supported, with, for example, incorporation of data held by other government bodies such as the Met. Service (precipitation and evapotranspiration) into this platform.

3.11.1 Jamaica Water Sector Policy, Strategies and Action Plan

The policy objectives are:

- Water Resources Management – the management, assessment and regulation of Jamaica's water resources. It will see the creation of a comprehensive database, water quality monitoring and assessment.

- Urban Water & Sewerage – provision of the necessary quality of potable water and minimum standard of sanitation services to all at an affordable price. It also envisions improvements in sewerage treatment and disposal, proper disposal of industrial effluent and the protection of the environment. Will seek to encourage private investments in new infrastructure through Public/Private Partnerships (PPP).

- Rural Water Sanitation – by 2010 all households rural and urban will have full access to potable water through various modalities and that by 2020 all major towns will be sewered.

- Urban Drainage – to be addressed as an integral part of the Water Sector.

- Irrigation – irrigation water to be provided in a cost effective and efficient manner with due regard to cost recovery. Promote formation and legislation of Water Users Associations (WUA).

3.11.1.1 Jamaica Water Sector Policy, Strategies and Action Plan

The Water Sector Policy does not incorporate climate change considerations. The Policy and Plan is currently being revised, and will include climate change considerations.

3.11.2 Towards a Watershed Policy for Jamaica (1999)

This policy, in advocating the employment of watershed management as an environmental management model for Jamaica, provides for an integrated approach to protection conservation and development of land and water resources for their sustainable use and for the benefit of the nation as a whole. It gives an overview of watershed problems, past interventions, current international trends in watershed management, and highlights major challenges to be faced in watershed management as well as key principles and strategies being employed by the policy to address these challenges.

This policy is currently being reviewed.

3.11.3 Water Resources Authority Act, 1995

The Water Resources Authority Act was promulgated to regulate and manage the abstraction and allocation of water resources through the establishment of water resources through the establishment of the Water Resources Authority. The Act also governs the preservation of water quality and the conservation of such resources. The Authority is required to gather data on the quantity and quality of water in above ground and underground resources. A Master Plan as required under the Act, has been developed to allow the proper management of such resources. It evaluates and recommends how Jamaica should use its water resources. A licensing system is in place to govern the allocation of water resources.

The Water Resources Act provides for:

- The management, protection and controlled allocation and use of water resources (regulate, allocate, conserve, and otherwise manage the water resources of Jamaica);

- The Act also provides for water quality control and for the establishment and functions of a Water Resources Authority. The Water Resources Authority may:

    - Obtain, compile, store and disseminate data concerning water resources;

    - Exercise such planning functions relating to the Master Plan and Water Quality Control Plans, and

    - Provide to any department or agency of Government, at its request, technical assistance in respect of any projects, programmes or activities that relate to the development, conservation and use of water resources.

The Water Resources Act also repeals the Water Act and the Underground Water Control Act and makes consequential amendments to certain enactment.

3.11.4 Watershed Protection Act, 1965

The Watershed Protection Act provides a framework for the management of watersheds in Jamaica. There are 26 watershed management units declared under the Act. The Act governs the entire island of Jamaica and makes provisions for the intervention of the Government in regulating uses of private land including the clearing of land and implementing appropriate agricultural practices. There are also provisions for intervention through assisted improvement agreements whereby improvement works can be carried out on land to protect watersheds.

No regulations have ever been prepared under this Act and therefore voluntary compliance and training have been the only measures available to ensure appropriate management practices in watersheds in Jamaica. Proposed amendments to the Watershed Act have been completed to remedy the deficiencies in the Act, as there is currently no legal framework for appropriate soil conservation and land use management measures that can be implemented.

3.11.5 Comparison with Recommendations in JSNC

In Jamaica's Second National Communication to the UNFCCC, recommendations were made for the water sector, however, few are presently addressed in policies and legislation. Some of the recommendations which are not addressed are:

- Formalization of linkages between UWI Climate Group and Stakeholders;
- Development of appropriate national flood risk mapping to support emergency operations and land use planning - although the Water Sector Policy, Strategy and Action Plan speaks to the creation of a comprehensive database for water resources management;
- Increasing and maintaining investment in hydrological monitoring and water use with a national database;
- Leveraging and co-ordinating international funding to maximize benefits within the water sector;
- Supporting and expanding funding of the IWCAM programme and National Forestry Plan;
- Development of appropriate modeling tools to assist strategic planning of water resources to supply;
- Supporting and funding increased water use efficiency across all water use sectors – irrigation, domestic and industrial users. The Water Sector Policy Strategy and Action Plan only looks at irrigation;
- Funding research into adopting water resources and water supply planning methods under climate change;
- Investigation of shifting the focus from groundwater to surface water storage for water supply;
- Removal of the NWC from the Ministry of Water and Housing and placing under alternative ministerial control;
- Merging government agencies and bodies responsible for land and water protection and management into one organization under one ministry of the GOJ.

4 Major National Initiatives

4.1 Vision 2030 Jamaica: National Development Plan

In 2009, the GoJ through the PIOJ presented its "Vision 2030 Jamaica: National Development Plan" which is intended to redefine the strategic direction for Jamaica towards sustainable prosperity. The vision is for Jamaica to move toward development of cultural, human, knowledge and institutional capital stocks so as to attain higher stages of development by 2030.

Vision 2030 Jamaica: National Development Plan provides the overarching context within which Jamaica's mitigation activities will take place. Under Vision 2030 Jamaica: National Development Plan, two national strategies – Develop measures to adapt to climate change and contribute to the effort to reduce the global rate of climate change – specifically speak to the strategies and actions that Jamaica will employ to reduce its greenhouse gas emissions to 2030. Vision 2030 articulates, "*Mitigation, through reducing greenhouse gas emissions, will be addressed through greater energy conservation. Energy conservation in Jamaica will put us in a "win-win" situation as it provides other substantial positive economic, social and environmental benefits. As described earlier in National Outcome 10 of the Plan, energy conservation efforts, use of cleaner technologies and development of alternate energy will result in lower spending on imported oil, less pollution and reduction in pollution-related illnesses. We will engage in reforestation to increase the amount of greenhouse gases removed from the atmosphere, provide improved watersheds and waterways and reduce landslides and soil erosion. These measures (energy conservation and reforestation), if pursued on a global scale, will mitigate and reduce the global rate of climate change*".

Vision 2030 has seven guiding principles on which the plan is based, one of which is sustainability (economic, social, environmental). There are four goals:

1. Jamaicans are empowered to achieve their fullest potential;

2. The Jamaican society is secure, cohesive and just;

3. Jamaica's economy is prosperous;

4. Jamaica has a healthy natural environment through sustainable management and use of environmental and natural resources, hazard risk reduction and adaptation to climate change, and sustainable urban and rural development.

In pursuit of Goal 4, Jamaica will ensure that environmental considerations become integral factors in socio-economic decision-making in order to transition the country into a green economy (Jamaica PIOJ, 2009). Attention will be given to increasing public awareness on environmental matters, and increasing participation in the management of natural resources; providing an effective regulatory framework for conservation of Jamaica's natural resources; incorporating environmental considerations into decision-making processes; determining the economic value of biodiversity and ecosystem services, as well as determining the long-term economic consequences of the continuing loss of biodiversity; and preserving and renewing ecological capital (Jamaica PIOJ, 2009).

Three outcomes linked to Goal 4 are:
#13 Sustainable Management and Use of Environmental and Natural Resources;
#14 Hazard Risk Reduction and Adaptation to Climate Change;
#15 Sustainable Urban and Rural Development.

Climate change scenarios will be incorporated in future economic and land use planning and provide a framework to ensure that risks associated with natural hazards will be reduced by integrating hazard considerations into Jamaica's development planning (Jamaica PIOJ, 2009). It is fair to say that several of the other Goals and Outcomes are either directly or indirectly linked to reduction of loss from the occurrence of extreme natural or technological events. In that regard, the importance of an effectively designed and implemented disaster risk management programme is germane to sustainable prosperity in Jamaica.

According to the PIOJ (2009), Jamaica's planning efforts have had limited success due to weaknesses which include relatively short-term planning, "inadequate resources to support implementation, an ineffective monitoring and evaluation framework, limited involvement of non-state actors, weak synergies between targets, indicators and the budget." The Vision 2030 Jamaica plan will focus on implementation and accountability and will depend on results-based management using targets and performance indicators at national and sectoral levels "to measure the effects of the actions being implemented in the medium and the long-term."

NEPA has indicated that the agency will integrate strategies to achieve the environmental goals of Vision 2030 into their Operational and Business plans.

4.1.1 Poverty Reduction Sectoral Plan

The implementation of the Poverty Reduction Sector Plan is an essential component of the implementation, monitoring and evaluation framework for the Vision 2030 Jamaica – National Development Plan (Jamaica PIOJ, 2009c). The Plan is implemented at the sectoral level by ministries, departments and agencies (MDAs) of Government

as well as non-state stakeholders including the private sector, NGOs and CBOs (Jamaica PIOJ, 2009c).

The Poverty Reduction Strategic Plan addresses issues that impact on long-term national development. It is one of 31 sector plans that will contribute to the achievement of the National Vision, "Jamaica the place of choice to live, work, raise families and do business" articulated in the National Development Plan, Vision 2030 Jamaica. This Sector Plan was crafted around the following vision developed by the Task Force: "Each person has the opportunity, capability and support needed to enjoy a sustainable and socially acceptable quality of life" (Jamaica PIOJ, 2009c).

Poverty is multi-dimensional and complex, and is influenced by many factors, even as it has wide impact on others. Where poverty is defined as the state of being poor – unable to effectively meet basic human survival needs – the attempts to address it have to be focused and specific. The existence of poverty in a country's population stymies the potential for economic growth and national development, as it reduces overall productivity, exerts pressure on Government resources, and often produces social instability. Where measures are successful in reducing the number of persons living in poverty, the entire society therefore benefits (Jamaica PIOJ, 2009c).

Poverty reduction i.e. a decrease in the proportion (and numbers) of persons whose basic human needs are not met is one of the key strategic areas of focus in social protection. It is that dimension of state social assistance that seeks to provide sustainable solutions for impoverished households and individuals, by focusing on both demand and supply-side issues within the labour and capital markets. This entails examining strong support to a low-inflation economic model. These policies have contributed to increasing the levels of disposable income and consumption of the poor. The ongoing development of the rural economy through policies and projects that support small-scale producers, as well as encourage and facilitate large-scale infrastructure development and tourism, have all had varying impacts on employment and incomes (Jamaica PIOJ, 2009c).

4.1.1.1 Resource Allocation for Implementation

Vision 2030 Jamaica places great emphasis on ensuring that resource allocation mechanisms are successfully aligned and integrated with the implementation phase of the National Development Plan and sector plans. The requirements to ensure resource allocation for implementation will include alignment of organizational plans in the public sector, private sector and civil society with the National Development Plan, MTF and sector plans; coherence between the various agency plans with the National Budget; rationalization of the prioritization process for public sector expenditure; and increased coordination between corporate planners, project managers and financial officers across ministries and agencies (Jamaica PIOJ, 2009c).

4.1.1.2 Action Plan

The Action Plan represents the main framework for the implementation of the Poverty Reduction Sector Plan for Vision 2030 Jamaica. The tracking of implementation of this Plan will take place through the Action Plan as well as the framework of sector indicators and targets.

The Action Plan contains the following elements:

i. Sector Goals
ii. Sector Outcomes
iii. Sector Strategies
iv. Sector Actions
v. Responsible Agencies
vi. Timeframe

4.1.2 Agriculture Sector Plan

The National Agriculture Sector Plan aims to reposition the agricultural sector within the context of the Vision 2030-National Development Plan (Jamaica PIOJ, 2009b). The plan aims to achieve the following goals and outcomes:

Goal 1: Efficient Competitive Diversified Value-Added Agricultural Production

- Increased Productivity and Cost Efficiency of Agricultural Enterprises;
- Diversified Range of Agricultural Production including Higher Value-Added Production;
- Strengthened Application of Technology, Innovation, Research and Development to Agricultural Production;
- Development of Key Sub-Sectors

Goal 2: Strong Marketing Systems for Domestic and Export Markets

- Strong and Effective Marketing Information System;
- Supportive Marketing and Distribution Infrastructure and Network;
- Development of Expanded and New Markets for Jamaican Agricultural Products

Goal 3: Competent and Adequate Human Resources

- Provision of Work Force with Skills, Training and Education to Meet the Dynamic Needs of Sector;
- Adequate Long-Term Supply of Labour Force for Sector Development

Goal 4: Enabling and Facilitating Framework, Infrastructure and Support Services

- Appropriate Policy, Legislation and Regulations for Long-Term Development of Sector;
- Improved Access to Financing;
- Strengthened Facilitating Institutions;
- Strengthened Extension Services; Modernized and Upgraded Infrastructure and Facilitating Institutions;
- Satisfactory Working Conditions, Health and Safety of Sector Employees

Goal 5: Contributor to Long-Term Rural Development

- Provision of Sustainable Livelihoods for Agricultural Community Residents;
- Comprehensive Land Use Planning and Utilization for Agricultural Development;
- Establishment of a Culture of Holistic Community Development.

Goal 6: An Environmentally Sustainable Sector

- High Application of Environmental Standards and Good Agricultural Practices;
- Organic Farming as Major Mode of Production;
- Strengthened Risk and Hazard Mitigation for Sector.

Goal 7: National Food Security

- Increased Access to Adequate and Safe Food Supplies for Population;

- Increased Domestic Food Production;
- Improved Nutritional Status of the Population through Consumption of Healthy Foods.

4.1.2.1 Fisheries

While the Sector Plan recognizes that Jamaica's waters are the most over-fished in the Caribbean and that biodiversity is affected, there is nothing to address climate change.

4.1.3 Tourism Sector Plan 2009 states:

4.1.3.1 Climate Change

> *Global warming is expected to play a major role in how the tourism and travel industry develops and operates. Best practices in coastal and marine preservation, ecological management, and waste management systems need to become priorities in the industry. The preservation of coral reefs, cruise waste disposal systems, drainage in resort areas, wetlands and deforestation concerns in development of resorts, among other things, are factors of which the industry must become more aware. Issues of changing climatic conditions on resorts, the environmental costs of air travel and the potential impact of rising sea levels on shoreline developments all show how important it is for proper planning, monitoring and policy mechanisms to ensure sustainability in the tourism industry.*

Concern about climate change is increasing world-wide and the IPCC has made it clear that global climate change is only just beginning. The impacts of climate change on the tourism sector will steadily intensify, particularly under higher emission scenarios. Climate change would redistribute climate resources for tourism geographically and seasonally and poses a risk to ecosystems worldwide. The nature and intensity of climate change impacts will differ for tourism destinations around the world. The most vulnerable regions are in developing countries, which generally also have less adaptive capacity, and this will be a particular challenge for their tourist destinations and their host communities. Climate change impacts on the tourism sector could influence other economic sectors, such as agriculture and local business networks supplying tourism. Conversely, the tourism sector must also be cognizant of the implications of climate change adaptation in other economic sectors, which could have significant impacts on tourism. As the financial sector incorporates a company's climate Change strategy, or lack of one, into its investment criteria, it will influence credit rating and insurance rates.

4.1.4 Sector Plan for Natural Resources and Environmental Management and Hazard Risk Reduction and Climate Change

The Vision 2030 Sector Plan for Natural Resources and Environmental Management and Hazard Risk Reduction and Climate Change is premised on a vision shared by hundreds of Jamaicans on the state of the natural environment and the importance of protecting and preserving it and the important roles society can collectively play in shaping the planning process to 2030. Additionally, incorporated in this Sector Plan is a set of adaptation strategies to better enable Jamaica to cope with the impacts associated with climate change. Climate change is included in this context because of the many impacts that its effects can have on natural resources and consequently the state of the natural environment. Reducing disaster risk such as those that can be created by climate change and protecting the natural environment are complementary and often involve identical practices.

Integrating disaster risk reduction, climate change and environmental management is an appropriate method for addressing disaster as the integration is known to create many synergies, such as reducing the cost of implementing parallel programmes and activities.

The Plan is one of thirty-one chapters that would form the foundation for the development of Jamaica 2030 – a 21 year plan designed to put Jamaica in a position to achieve developed country status by 2030. Vision 2030 Jamaica is based on a fundamental vision to make 'Jamaica the place of choice to live, work, raise families, and do business,' and on guiding principles which put 'people' at the centre of Jamaica's transformation.

5 OTHER KEY POLICIES, PLANS, GUIDELINES AND LEGISLATION

There are a wide range of policies that need to be reviewed in the context of mainstreaming climate change. Climate change data should be used in the current review of policies and plans, and all policies should be reviewed against the background of emerging climate change data, but definitely every three years.

There is a National Commission on Science and Technology which has produced two Science and Technology Policies (1990 and 2005), but neither policy has incorporated climate change.

5.1 Draft Jamaica National Climate Change Policy and Action Plan (JNCCPA)

This plan was drafted in July 2010. It outlines the expected effects of climate change on Jamaica; climate observations and trends; Jamaica's efforts and achievements in climate change adaptation and mitigation; challenges facing Jamaica in addressing climate change; and looks at specific sectors which will be affected by climate change.

The main goal of the draft JNCCPA is to:

1. Ensure a coordinated, sustained and equitable approach towards reducing the country's anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol of the Vienna Convention on Substances the Deplete the Ozone Layer
2. Determine Jamaica's vulnerability to the adverse effects of climate change by firstly identifying the potential impacts and secondly developing and implementing the necessary measures that will be required to minimize these impacts over the short, medium and long term.

The central focus of the policy will be the achievement of development goals and objectives, while yielding co-benefits for climate change.

The draft JNCCPA outlines a multi-sectoral approach to address climate change and outlines strategies for various sectors and resources.

In terms of planning and management, the GOJ will, *inter alia*, establish a National Climate Change Committee under the auspices of the PIOJ; incorporate climate change considerations into budgetary processes and procedures; establish a national climate change database and information system to be used by all relevant agencies; establish an effective legal and institutional framework for the maintenance and

enhancement of the natural environment. The Ministry with responsibility for the Meteorological Service (national focal point to the UNFCCC) should have administrative oversight and responsibility for climate change initiatives. However, all Ministries or agencies will have responsibility for implementing specific activities or programmes to address climate change and shall report as required to the National Climate Change Committee (NCCC) when established.

The NCCC will monitor the implementation of the Climate Change Adaptation Policy. The NCCC must have approval from Cabinet and will be subject to review of its Mandate, Terms of Reference and composition by Cabinet with a view of recommending improvement to better equip it to fulfill its mandate. The NCCC will report to Cabinet on a semi-annual basis through the PIOJ, as well as any other time deemed necessary. An annual report will be presented to Cabinet on measures that have been undertaken to implement this policy. The NCCC will conduct a public review on the fifth anniversary of the date of the policy to determine its effectiveness in achieving goals and objectives.

5.2 NEPA Climate Change Response Strategy 2010-2015

The primary goal of the strategy is to ensure the integration of climate change mitigation and adaptation measures into NEPA's policies plans and programmes in keeping with the national priorities and objectives for climate change mitigation and response. NEPA's climate change response strategy focuses on the following key areas:

1. Measures to support the increase in the natural resilience of coastal ecosystems and biodiversity;

2. The integration of climate change considerations into environmental policies and plans;

3. Encourage the use of alternative energy sources;

4. Measures to support disaster risk reduction;

5. Climate change awareness.

Specific Strategies are included to address the following:

- disaster risk reduction,
- coastal and marine ecosystems, and
- terrestrial ecosystems,

- infrastructure, and
- energy use.

Disaster Risk Reduction
The permanent shocks and changes in extreme events are expected to potentially result in a loss of livelihood, and the degradation of Jamaica's resource base, including damage to natural ecosystems and economic and social infrastructure.

A wide range of strategies have been developed to deal with the impact of coastal and marine ecosystems. These include vulnerability assessments, data collection, review of species, protected areas and spatial plan to incorporate climate change, public awareness and strengthening of the existing regulatory framework.

Terrestrial Ecosystems
As regards Terrestrial ecosystems a comprehensive range of strategies have been developed to address climate change issues, including monitoring threatened and endangered species; ensuring environmental and planning policies strategies and plans include climate change considerations, integrate climate change consideration in the physical planning and EIA process includes others.

Infrastructure
As regards infrastructure of major communities located in the coastal zone a comprehensive range of strategies are proposed. These include the design and construction of building, set back limits, public awareness, data gathering and early warning protocols among others.

Energy Use
Given that the energy usage is of critical importance a wide number of strategies have been developed including public awareness, participation on a clean development mechanism, greater use of renewables.

5.3 Jamaica National Energy Policy

Jamaica National Energy Policy 2009-2030 defines a strategic framework and comprehensive goals to 2030 and beyond, that address both supply and demand energy issues the country faces and places priority attention on seven key areas:

i. Security of energy supply through diversification of fuels as well as development of renewable;

ii. Modernizing the country's energy infrastructure

iii. Development of renewable energy sources such as solar and hydro

iv. Energy conservation and efficiency

v. Development of a comprehensive governance/regulatory framework

vi. Enabling government ministries, departments and agencies to be model/leader for the rest of society in terms of energy management

vii. Eco-efficiency in industries

Each of these seven priority areas, when implemented will reduce Jamaica's GHG emissions. Other policies to be developed include the Renewable Energy Policy, the Biofuels Policy and the Energy Conservation and Efficiency Protocol (EOE) for the management and use of energy in the public sector. The EOE speaks to the operation of public sector facilities and entities. All of the aforementioned policies when implemented will help in the reduction of GHG emissions.

The vision of the National Energy Policy is, "A modern, efficient, diversified and environmentally sustainable energy sector providing affordable and accessible energy supplies with long-term energy security and supported by informed public behaviour on energy issues and an appropriate policy, regulatory and institutional framework" (Jamaica Ministry of Energy, 2010). Jamaica is vulnerable to the effects of climate change such as sea level rise, and damage by extreme weather events (Jamaica Ministry of Energy, 2010). A fundamental element of the Energy Policy is that the energy sector will be environmentally sustainable with significantly increased use of economically viable renewable energy sources such as solar, wind, hydropower, and biofuels (Jamaica Ministry of Energy, 2010). An increase in the use of renewable energy sources will contribute to the reduction in global emissions of greenhouse gases and global warming and the effects of climate change (Jamaica Ministry of Energy, 2010).

The GOJ has several policy and regulatory initiatives concerned with energy use and environmental protection (Jamaica Ministry of Energy, 2010):

- Environmental Stewardship of Government Operations Policy – this has been drafted as part of the GOJ's goal of enabling GOJ entities to become more efficient in their operations, generating significant cost savings while eliminating or minimizing adverse impacts on the environment.

- Environmental Management Systems Policy and Strategy Green Paper – an environment management system is a management tool which enables an organization to address the impacts on its products, processes and services on the environment, including its use of energy and management of waste.

- Jamaican Ambient Air Quality Standards – this was promulgated by the NRCA in 1996 and 2006. Some of the main features of the air quality regulations include an air pollutant discharge licensing system and the payment of discharge fees for emissions or discharges to the environment. There is also a requirement that all holders of a licence complete a summary report of annual actual emissions for regulated pollutants and greenhouse gases.

The National Energy Policy has targets for percentage of renewables in energy mix of 11% by 2012, and 15% by 2020. Renewable energy sources include solar energy, biogas, wind, and hydropower. Mechanisms to reduce carbon emissions, and carbon trading will be developed (Jamaica PIOJ, 2009).

The objectives of the energy policy of Jamaica are as follows:

a) To ensure stable and adequate energy supplies at the least economic cost in a deregulated and liberalized environment;

b) To diversify the energy base and encourage the development of indigenous energy resources where economically viable and technically feasible; and ensure the security of energy supplies;

c) Encourage efficiency in energy production, conversion and use with the overall objectives of reducing the energy intensity of the economy;

d) Complement the country's Industrial Policy recognizing the importance of energy as a critical in out to industrial growth and stability;

e) Minimize the adverse environmental effects and pollution caused by the production, storage, transport and use of energy, and minimize environmental degradation as a result of the use of fuel wood and;

f) Establish an appropriate regulatory framework to protect consumers, investors and the environment.

In order to achieve the objectives of the energy policy an enabling environment has been created to:

a) Encourage private sector participation and investments through a policy of divestment and an appropriate regulatory framework conducive to new investment;

b) Promote the development of indigenous energy source where appropriate technically and economically feasible;

d) Encourage energy conservation/efficiency on the supply side as well as demand side management;

e) Fully protect the environment while ensuring that adequate energy supplies are available to the country and to sustain the desired rate of economic growth, and at the same time stimulate industrial development by encouraging synergies from co-generation; and

f) Maintain appropriate institutional arrangements to ensure that the stated objectives achieved.

The energy policy of Jamaica is designed to continue to foster, facilitate and encourage the development of all new and renewable energy sources, improve information dissemination with regards to energy conservation systems and promote and support Demand Side Management. With regards to economic incentives, the energy policy notes that the tax applied on energy conservation equipment and materials and supplies will be such that it will ensure that the items involved are available to the public and that the consumers will be encouraged to invest in the most efficient end use device or technology.

5.4 National Renewable Energy Policy 2009 – 2030 …Creating a Sustainable Future

Jamaica's Renewable Energy Policy is designed to achieve, "A well-developed, vibrant and diversified renewable energy sector that contributes to Jamaica's energy security and a sustainable future". The policy was created in response to the National Energy Policy which calls for 20% of the country's energy mix to come from renewable sources, and for the development of the energy sector especially in areas related to renewables, diversification of fuels, biofuels and waste-to-energy. The policy acknowledges the challenge of climate change and energy security and will promote sustainable development by protecting the environment and contributing to economic development, while at the same time joining international efforts to curb the impacts of climate change. The Renewable Energy Policy will create the framework for the Energy-from-Waste and the Biofuels Policies (Jamaica Ministry of Energy, 2010b).

The Policy also recognizes the Clean Development Mechanism within the development of a renewable energy sector (Jamaica Ministry of Energy, 2010b).

The five goals of the policy are (Jamaica Ministry of Energy, 2010b):

1. Economic, infrastructural and planning conditions conducive to Renewable Energy (RE) development
2. Financial and fiscal policy instruments
3. Legislative and regulatory environment
4. Awareness raising, capacity building and education
5. Technology development and the promotion and introduction of RETs

In the action plan for the policy there are plans for the expansion of hydro-power capacity; to increase wind energy generation capacity; and to promote solar technologies to comply with international conventions on climate change and global warming (Jamaica Ministry of Energy, 2010b).

5.5 Draft Carbon Emissions Trading Policy

Jamaica's Draft Carbon Emissions Trading Policy (2009) sets out a comprehensive framework for Jamaica's participation in the carbon trading market. It presents Government's positions, defines investment priorities, establishes the institutional and legal framework and facilitates structures necessary for the effective management of the regime involving the participation of all sectors in a manner that is mutually beneficial to all. The overarching objective of this draft policy is to position Jamaica to capitalize further on other opportunities for partnerships with other developed countries, private organizations, as well as relevant regional or international institutions. This will generate social, economic and environmental benefits for the country through investment in initiatives that will foster our sustainable development goals.

The Office of Utilities Regulation (OUR) issued the Regulatory Policy for the addition of new generating capacity to the public electricity supply system that guides the process for the addition of new generating capacity to the Jamaican electricity grid. The policy is a necessary complement to the All Island Electric Licence, 2001 which gives JPS the exclusive right to transmit and distribute electricity and as of 2004, the right to compete with other electricity producers for the opportunity to develop new generation capacity. This OUR policy has accompanying schedules that detail the procedures by which capacity can be added to the system and it is intended to facilitate the long term expansion of generation at the least economic cost while giving due regard to the relevant policies and applicable legislation. According to the policy, the addition of new capacity to the grid can be achieved by:

- the installation of conventional technologies,
- the utilization of renewable sources, and;
- the setting up of co-generation installations

5.6 National Transport Policy

The National Transport Policy (draft) is designed to encourage measures such as energy conservation, including: efficient traffic management; car-pooling; park and ride; use of clean fuels to minimize pollution; flexi-work hours and tele-commuting; an efficient public/urban mass transit transport system; and use of non-motorized transport; and, promoting vehicle and road maintenance programmes. Supporting legislation and infrastructure for use of biofuels will be put in place. The transport policy also will encourage more efficient modes of transport such as barges especially for bulky materials like aggregates. The possibility of enhanced coastal and rail transport will be kept under constant review. All these would involve less use of petroleum and therefore be beneficial in reducing GHG emissions.

To guide the overall development of the transport sector and to provide the framework for the development of environmentally-sound transport infrastructure and services in support of sustainable economic and social growth.

5.7 Integrated Solid Waste Management Policy

Figure 2. Garbage Collected from the Mangroves on the Sides of the Road to Port Royal

The policy covers the following issues in relation to solid waste management:

- Regulatory Framework
- Institutional Framework

- Cost Recovery
- Operational issues related to collection, transportation and disposal
- Waste minimization – reduce, reuse, recycle
- Waste processing
- Hazardous and medical waste
- Public education
- Relationship to other national policies and legislation
- Enforcement

5.8 Policy on Environmental Stewardship of Government Operations

The Policy on Environmental Stewardship of Government Operations has been drafted as part of the Government of Jamaica's goal of enabling GOJ entities to become more efficient in their operations, generating significant cost savings while eliminating or minimizing adverse impacts on the environment. The Environmental Stewardship Policy speaks to among other things, Energy Conservation, Water Conservation and Fleet Management – aspects of government operations that have an impact on the overall use of energy.

5.9 Draft Strategic Environmental Assessment (SEA) Policy

As part of the Government's commitment, the GoJ seeks to ensure that all policies, plans and programmes geared towards national development adequately consider potential environmental effects and where they are adverse incorporate appropriate measures to reduce or eliminate these effects and impacts.

The SEA Policy seeks to fulfill a wide range of goals. These include:

- long term improvements of the environment, protection and conservation of the environment for protection of health,
- change in practices towards the environment
- ensuring that developments are kept within the country's carrying capacity
- ensuring that sustainable development is effectively implemented
- accountability and credibility among members of the public and all stakeholders and
- giving greater attention to potential liabilities for environmental clean ups.

SEA initially will be applied to agencies whose primary function is geared towards economic development. These agencies include: Finance and Planning, Transportation and Works, Commerce, Science and Technology, UDC, JAMPTO, and all local Planning Authorities.

5.10 Policy for Jamaica's System of Protected Areas (1997)

The Policy formulated pursuant to Section 5 of the Natural Resources Conservation Authority Act, describes the protected areas system as having a common underlying foundation of environmental protection purposes, and a standardized approach to planning and management. It is a useful tool in the employment of ICZM as a management model. The policy defines a protected area as an area of water or land that is managed for the protection and maintenance of its ecological systems, biodiversity and/or specific natural, cultural or aesthetic resources. It is envisaged that the system will be an essential tool for environmental protection, conserving essential resources for sustainable use, helping to expand and diversify economic development and contributing to public recreation and education. The need for community based management or local co-management programs and sustainable management programs are also emphasized. The goals of the protected areas system are expressed as economic development, and environmental conservation. Types of protected areas include marine parks; habitat species management areas; National Protected landscape/seascape; and managed resource protected areas.

A Protected Areas System Master Plan is being prepared which contains climate change considerations.

5.11 Jamaica National Environmental Action Plan

To promote sustainable development in Jamaica by supporting capacity development of key Jamaican organisations involved in decision-making, management and the use of Jamaica's natural resources.

5.12 National Strategy and Action Plan on Biological Diversity

To ensure the most sustainable use and conservation of the country's biological resources in keeping with the Convention on Biological Diversity (to which Jamaica is a party).

5.13 Protected Areas System Master Plan (Draft)

In preparing the Master Plan, Jamaica undertook an ecological gap analysis to assess:

- where the nation's current protected areas systems fall short of protecting all bio-diversity;
- the effectiveness of existing Protected Areas;

- the development a plan to build the capacity of Protected Areas management at the local and system level;

- and the financial gap as well as planned the long term financial stability of managing the areas.

The Jamaica Protected Areas Policy of 1997 defines a protected area as an area of land or water that is managed for the protection and maintenance of its ecological systems, biological diversity and or specific natural, cultural and aesthetic resources. These are areas with birds, plants or marine life that are important to the island's eco systems, culture and beauty. Particular attention is paid to those in danger of becoming extinct or severely depleted by human or natural activities such as weather patterns including climate change, and which are found in a particular area.

The areas where they are highly concentrated are designated Protected Areas which helps in their management and protection. They are protected from being removed, hunted, harvested or destroyed by certain Acts and regulations. The Blue and John Crow Mountains, popular for the world renowned Blue Mountain coffee, endemic birds and other wild life as well as flora and fauna, is one such area.

There are eight Protected Areas declared under the Natural Resources Conservation Authority Act and several forest reserves and heritage sites have been declared as well as a fishing sanctuary. The practice of declaring Protected Areas began in the 1930s under the Beach Control and Forest Acts and other existing pieces of legislation. However, Headley said the Master Plan will pull all these efforts together and provide a framework for managing and regulating activities in those areas.

The IUCN defines the Protected Areas System Plan as the primary national policy document for strengthening management and extending protected area coverage.

The development of The Protected Areas System Master Plan fulfills Jamaica's obligation under the Convention on Biological Diversity. In 2004, the Convention adopted a set of goals and objectives on protected areas called the "Programme of Work on Protected Areas, which is a three phased programme from 2004-2012."

The Protected Areas System Master Plan contains climate change considerations.

5.14 Natural Resource Conservation Authority Act

The Natural Resources Conservation Authority Act established a statutory body to "provide for the management, conservation, and protection of the natural resources of Jamaica". The Act also empowers NRCA to establish policies, promulgate regulations and standards, and develop and implement strategies to achieve this

goal. NRCA is by virtue of the Act the primary agency for environmental management in Jamaica.

Under the NRCA Act, a licence is required to discharge any poisonous, noxious or polluting substance into waters or the ground. Licences are also used to control the quality of effluent discharged. Regulations and Standards governing the discharge of wastewater are soon to be completed.

The NRCA Act is the only Act in Jamaica that includes a requirement to conduct EIAs. Section 10 of the Act stipulates that the Authority may require an EIA.

Natural Resources Conservation Authority Act (1991) provides for the management, conservation and protection of Jamaica's natural resources. The Act establishes the Natural Resources Conservation Authority (NRCA), whose functions include the taking of such steps that are necessary to ensure the effective management of the physical environment of Jamaica. Section 9 of the Act gives Ministerial discretion to declare parts of or the entire island a 'prescribed area', in which specified activities require a permit, and for which activities an environmental impact assessment may be required. The Natural Resources Conservation Authority (Permits and Licences) Regulations (1996) sets categories of enterprises that will require a permit for their development or construction and the requirements for licences for those enterprises. The Natural Resources Conservation Authority (Air Quality) Regulations (2006) sets out the criteria that determine which facilities require a licence to discharge certain pollutants and prescribe discharge fees. The regulations also include a requirement that licensees provide annual emissions reports for emissions of the so called regulated pollutants and greenhouse gases.

There are no immediate plans to update this Act, however, a NEPA Act is being considered.

5.14.1 Natural Resources Conservation (Blue and John Crow Mountains National Park) (Declaration) Order (1993) and the Natural Resources National Parks Regulations

The Order establishes the Blue and John Crow Mountain National Park while the regulations govern activities within all national parks. Included in the regulations are provisions pertaining to the control of animals, littering, pollution of lakes and streams, use of poisons, disorderly behavior. The Act also provides for the designation of camping areas, restrictions on the use of fires, commercial activities, mining and research, etc. zoning, monitoring and enforcement are also addressed.

There are no immediate plans to update this order and regulations.

5.14.2 Natural Resources (Blue and John Crow Mountains National Park) (User Fees) Regulations (2003)

Under the Natural Resources Conservation (Blue and John Crow Mountains National Park) (User Fees) Regulations, 2002 (PRR 59C of 2003) a person shall not enter the recreational area of the Park unless he holds a valid pass. The fees for entry into the recreational areas are set out in the Schedule. The Park Manager is required under regulation 6 to establish an account in which the fees are to be deposited. In addition within three months after the end of each calendar year the Park Manager is required to present an audited report on the account to NRCA.

There are no immediate plans to update these regulations.

5.14.3 Natural Resources (Montego Bay Marine Park Order (1992) and Natural Resources (Marine Parks) Regulations (1992)

These regulations are enacted pursuant to Section 38 of the Natural Resources Conservation Authority Act. The object of the Order is to establish a marine protected area, primarily for the purpose of conserving the natural resources within the area. The regulations apply to all marine protected areas in which the following activities are prohibited; extraction or mining of minerals, the destruction, injury defacing, removing, digging, harmfully removing or disturbing any sand, gravel, minerals, corals, sea fans, shells, shell fish, or other marine invertebrate, seaweeds, grasses, soil rock, artifacts, stones or other materials. No person shall use, sell or otherwise dispose of the aforementioned knowing it to have been unlawfully removed from a marine park. The regulations also prohibit the discharge or deposit of any refuse, oily liquids, or wastes, acids or other deleterious chemicals or toxic or polluting substances of any kind which may be injurious to plant or animal life. In or on waters of a marine park, fishing without express permission is prohibited. With respect to fishing, the Authority is vested with a discretion to declare specified areas of a marine park to be no fishing zones, or where fishing is allowed, to specify the kind of fish which may be caught or the kind of fish in respect of which fishing is prohibited, or may establish individual quotas and fishing equipment that may be used. The Authority also has discretion to zone a marine park.

Drafting instructions for Marine Park and Managed Resource Protected Area regulations are being prepared.

5.14.4 Natural Resources Conservation Authority (Air Quality) Regulations, 2006 (hereinafter referred to as the Air Quality Regulations)

Under the Air Quality Regulations every operator of a major facility or significant facility shall apply for an air pollution licence. A licence may be issued in respect of any of the categories set out in the Fourth Schedule. The Regulations set out the prescribed form for applying for a licence.

Transfer of licences requires the bidder of the licence to notify the Authority. Regulation 9 sets out the licence fees applicable to each licence and the requirements for record keeping are embodied in regulation 10.

By regulation 11 a licensee shall submit an emission report in respect of each calendar year to the Authority within 6 months after the end of that calendar year, unless otherwise directed by the Authority.

Regulation 12 requires that the licensee shall pay to the Authority air pollution discharge fees. Discharge fees shall be waived from all emissions from the combustion of (a) renewable energy fuels (including bagasse) landfill gas and agricultural wastes), or (b) municipal waste, excluding only oily or hazardous or non-hazardous waste. However licensees in respect of existing facilities that have excess emissions or whose emissions are predicted to cause ambient air quality standards to be exceeded shall not be exempt from any discharge fees. Discharge fees for emissions from the combustion of recycled fuel may be reduced based on the caloric value of the fuel.

Part II of the Regulations (regulations 16 to 31) deal with Emission Standards, Guidelines, Testing and Monitoring, Part III of the Regulations (regulations 32 to 36) deal with Ambient Air Quality Monitoring and Assessment.

These regulations will be revised in the 2012/13 financial year.

5.14.5 The Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order, 1996 and The Natural Resources (Permits and Licenses Regulations)

Both the Order and the regulations were passed pursuant to Section 9 of the NRCA Act. The Order provides that the entire island of Jamaica is prescribed area and lists specified categories of enterprise, construction or development that require a permit and for which Environmental Impact Assessments may be required. Those relating directly to the conservation of marine resources include; port and harbor developments, and modification, clearance or reclamation of wetlands. Sewage effluent is addressed separately under the Act and provides in Section 12, that no person shall discharge on or cause or permit the entry into water, on the ground or into the ground any sewage, trade effluent or any poisonous, noxious or polluting matter. However, certain activities are exempt from this section. These include discharges, which are in accordance with good agricultural practices, discharges permitted in an emergency in order to

avoid a greater danger to the public or discharges from domestic waste effected by means of absorption or soak-away pits or other prescribed waste disposal systems.

The island of Jamaica and the Territorial Sea of Jamaica has been declared as a Prescribed Area. No person can undertake in Negril any enterprise, construction or development of a prescribed description of category except under and in accordance with a permit.
These will be revised in the 2012/13 financial year.

5.15 NRCA Guidelines for Environmental Impact Assessment (1998)

Section 10 of the NRCA Act gives the NRCA the discretion to request of any applicant for a permit or a license under Section 9 of the Act, an Environmental Impact Assessment (EIA). To facilitate the process the NRCA developed guidelines for conducting EIAs which includes a definition of an EIA, the EIA process, reporting and review procedures.

This guideline is being reviewed.

5.16 Endangered Species (Protection, Conservation and Regulation of Trade) Act, 2000

The Endangered Species Act provides for the conservation, protection and regulation of trade in endangered species. The Act was prepared to allow the Government of Jamaica to fulfil its obligations under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

There are four Schedules. The First Schedule governs endangered species that are threatened with extinction and which may be affected by trade. The Second Schedule governs species which could become extinct if trade is not regulated. The Third Schedule governs species which any contracting party wishes to regulate within its own jurisdiction. The Fourth Schedule is particular to Jamaica and lists Jamaican indigenous species. Domestic trade in these endangered species is controlled under the Regulations.

The regulations will be amended in the 2012/13 financial year.

5.17 National Heritage Trust Act (1985)

This Act provides for protection of areas, structures and objects of cultural significance to Jamaica by declaration of any structure as a national monument where preservation is of public interest due to historic, architectural, traditional, artistic, aesthetic, scientific or archaeological importance. This includes the floor of the sea within the territorial waters or the Exclusive Economic Zone.

6 COMPARATIVE DEVELOPMENTS

Jamaica is a party to the UNFCCC and the Kyoto Protocol. However, no legislation has yet been enacted in Jamaica to mainstream climate change. This section reviews comparative Policy developments within the CARICOM area. It also examines legislative models in other countries that have sought to enact legislative provisions to implement the UNFCCC and the Kyoto Protocol.

At present no CARICOM country has enacted legislation to domesticate the UNFCCC or to mainstream climate change. However, Dominica has draft legislation to enact an Environment and Climate Change Act. This draft Act will set up an Environment and Climate Change Department and give legal effect to a number of multilateral environmental agreements including the UNFCCC and the Kyoto Protocol.

6.1 Caribbean Developments - Policy

6.1.1 Belize Policy Statement

The Belize Climate Change Adaptation Policy encourages all agencies in Belize to explore and access the opportunities being developed by the climate change negotiation process such as capacity building, new sources of funding, and technology transfer. It also mandates the relevant government agencies to prepare adaptation policy options for their sectors.

6.1.2 St. Lucia: National Climate Change Policy and Adaptation Plan

The aim of Saint Lucia's National Climate Change Adaptation Policy is to foster and guide a national process of addressing the short, medium and long term effects of climate change in a coordinated, holistic and participatory manner in order to ensure that, to the greatest extent possible, the quality of life of the people of St. Lucia, and opportunities for sustainable development are not compromised.

This policy shall guide the work of all Governmental, statutory, Non-governmental and Civic entities which are involved in, or which may seek to become involved in addressing Climate Change issues as they affect St. Lucia.

St. Lucia's Climate Change Adaptation Policy and Strategy is based on an acceptance that climate change is occurring and that it will continue to occur even if immediate steps are taken to reduce global warming. It is also accepted that the effects thereof are likely to have a profound, and in sum, adverse, impact on the economic, social, and environmental aspects of life in St. Lucia and other Small Island Developing States. This Policy and Strategy bears testimony to St. Lucia's commitment to

confronting and addressing the challenges posed by the climate change phenomenon. Although a country of limited economic, financial and technological resources, we are prepared to adopt an integrated and coordinated approach to planning for, and ameliorating the effects of, climate change.

6.2 Developments Outside of the Caribbean Area - Legislation

6.2.1 Australia

Australia enacted a National Greenhouse and Energy Reporting Act in 2007, plus associated regulations. The Act requires reporting of GHG emissions, energy consumption and production by large companies and public disclosure, to underpin the planned Carbon Pollution Reduction Scheme. The State of South Australia introduced their Climate Change and Greenhouse Emissions Reduction Act in 2007. This legislation sets a target of reducing GHG emissions to 40% of 1990 levels by 2050, and aims to increase the proportion of renewable energy generated and consumed in the state to at least 20% by 2014 (King and Wirutskulshai 2009 cited by King 2010).

6.2.1.1 South Australia Climate Change Legislation

The Climate Change and Greenhouse Emissions Reduction Act 2007 made South Australia the first state in Australia to legislate targets to reduce greenhouse emissions.

The legislation sets out three targets:

- reduce greenhouse gas emissions within the state by at least 60% to an amount that is equal to or less than 40% of 1990 levels by 31 December 2050 as part of a national and international response to climate change;

- increase the proportion of renewable electricity generated so it comprises at least 20% of electricity generated in the state by 31 December 2014;

- increase the proportion of renewable electricity consumed so that it comprises at least 20% of electricity consumed in the state by 31 December 2014.

6.2.2 New Zealand Climate Change Response Act 2002

The Climate Change Response Act 2002 creates the legal framework for New Zealand to ratify the Kyoto Protocol and to meet obligations under the United Nations Framework Convention on Climate Change. It sets out powers for the Minister of Finance to manage New Zealand's holdings of Assigned amount units and to trade Kyoto-compliant emission units (carbon credits) on the international market. It

establishes a registry to record holdings and transfers of emission units. It establishes a national inventory agency to record and report greenhouse gas emissions.

The legislative purposes of the Climate Change Response Act 2002 are:

- to enable New Zealand to meet its obligations under the United Nations Framework Convention on Climate Change and the Kyoto Protocol, and,

- to provide for the a New Zealand Emissions Trading Scheme for greenhouse gases that reduces net emissions below business-as-usual levels.

The Climate Change Response (Emissions Trading) Amendment Act 2008 established the Fifth Labour Government of New Zealand's version of the New Zealand Emissions Trading Scheme in September 2008. Part 4 of the Climate Change Response Act sets out the New Zealand Emission Trading Scheme.

The Climate Change Response Act 2002 puts in place a legal framework to allow New Zealand to ratify the Kyoto Protocol and to meet its obligations under the United Nations Framework Convention on Climate Change.

6.2.3 Philippines Climate Change Act, 2009

The Climate Change Act, 2009 declares that the policy of the states is to systematically integrate the context of climate change in various phases of policy formulation, development plans, poverty reduction strategies and other development tools and techniques by all agencies and instrumentalities of the government. The Act also establishes a Climate Change Commission with responsibility to coordinate, monitor, and evaluate the programmes and action plans of the government relating to climate change pursued to the provisions of the act.

Under the Act the Commission is responsible for mainstreaming climate change in synergy with disaster risk reduction, international, sectional and local development plans and policies. The commission is also required to formulate a Framework strategy in change to serve as a basis for climate change planning. Research and development, extension and maintenance of activities on climate change. In addition, it will recommend legislation, policies, strategies, programmes on and appropriations and navigation and other related activities. It also is required to make recommendations on climate change sectors such as water resources, agriculture, fronts, coastal and natural resources, health and infrastructure to ensure the achievement of national substantial developmental goals.

6.2.4 United Kingdom

The UK passed a revised Energy Act and a Climate Change Act in 2008, which makes the government commitment to reduce carbon emissions by 80% by 2050 a legal requirement, binding future governments. The Climate Change Act paves the way for introduction of an emissions trading scheme. The Energy Act provides for feed-in tariffs, a renewable heat incentive, increased weight to be given to sustainable development, and other measures. British Columbia, Canada, adopted a Greenhouse Gas Reduction Targets Act in 2007 that requires an emissions reduction target 33% below 2007 level by 2020 and 80% below 2007 levels by 2050. All public sector organizations are required to become carbon neutral by 2010 and to report on their emissions, actions taken, and future plans towards carbon neutrality.

6.2.5 Nigeria

In Nigeria a Bill to establish a Climate Change Commission has been passed by both Houses of the National Assembly and now awaits presidential assent.

6.2.6 South Africa

South Africa is moving towards the introduction of Climate Change legislation. The proposed legislation would set emission reduction outcomes for each significant sector in the economy.

6.2.7 Review

While the focus of the Australian, UK and New Zealand legislation is on mitigation strategies, and is aimed at compliance with the requirements of the UNFCCC for these countries to reduce GHG emissions, Jamaica does not have an obligation under the UNFCCC to reduce GHG emissions. Therefore, the models developed in the Australian, UK and New Zealand statutes would not be applicable to Jamaica. The Philippines was the first developing country to enact climate change legislation and in this case, the focus is on adaptation, rather than mitigation. The Philippines model (followed by Indonesia and Nigeria) is to establish a Climate Change Act which establishes a Climate Change Commission whose focus is coordinating climate change and to recommend measures to implement climate change. The Philippines model of establishing a separate Climate Change Commission could be costly to implement.

Another option is to amend several existing statutes to mainstream climate change. In the context of Jamaica, this could be done by amending key pieces of legislation such as the NRCA Act, NRCA Regulations applicable to EIAs, Town and Country Planning Act to incorporate climate change considerations into these Acts. In

addition, issues relating to renewable energy can be dealt with in a Renewable Energy Act.

7 ASSESSMENT OF INFORMATION GAPS OF EXISTING GUIDELINES, SECTORAL PLANS, STRATEGIES, LAWS, REGULATIONS AND POLICY FRAMEWORK

7.1 Sectoral Development Plans and Strategies

7.1.1 Development Orders

The Development Plans are comprehensive plans used to guide development. Development Plans represent a vision and statement of criteria for future development and land-use in an area – they set out the planning policies and proposals which together form a spatial framework which largely determines where, how and what development takes place. The policies set out in the plan can also have a deeper influence on the precise design or layout of developments, the uses they involve, and the issues which local authorities will expect developers to tackle or address in drawing up their proposals for development.

There are a number of problems in relation to the planning framework.

- Outdated planning legislation guiding development;
- Lack of approved government policies on climate change
- Capacity issues:
    - Size of establishment;
    - Lack of trained planners and skilled staff at all levels: impedes research capacity etc.
    - Not enough specialist training in issues to do with planning
    - Financial constraints
- The gap between planning and environmental management has not been bridged (economic vs. environmental management)
- Planning system is supported by reactive initiatives

The Town and Country Planning (St. Ann Parish) Provisional Order, 1968 (PRR 34A/1998) contains the Provisional Development Order for St. Ann. The Order set out the procedure for planning application as well as the decision making process. The Order sets out various developments which do not require planning permission. These include development within the cartilage of a dwelling house, minor operations, temporary buildings, agricultural land on units 2.0 hectares or more, forestry buildings, repairs to unadapted streets and private ways.

The Order also sets out the planning framework, including the basic framework (demography, population composition, labour force, employment), mineral, conservation, etc.

A number of objectives are listed in the Order which are to provide the framework for the policies which will guide the local planning authority in their decision making process throughout St. Ann. The applicable objectives relate to transportation, housing, rural economy, minerals, water treatment and control, tourism, energy generation and telecommunications. There also are a number of sectoral policies which were identified.

There is no mention of climate change as to be expected from a document published in 1968.

Draft Development Orders have been prepared for Portland, Trelawny, Negril and Manchester but these are still pending. None of the draft Development Orders specifically refers to or takes climate change into account.

The current Development Orders do not deal adequately with climate change considerations.

7.1.1.1 Strengthen Regulations to Protect Ecological Buffers

While there are regulations governing the use of wetlands and mangroves, strengthening these measures to ensure that ecological buffers are protected should be a priority. The filling of wetlands, damming rivers, mining coral and beach sands and cutting of mangroves should be prohibited in order to preserve the natural storm abatement functions of these areas.

7.1.1.2 Develop Comprehensive Land-use Plans

The most immediate need for reducing island vulnerability to sea level rise is development of comprehensive land-use plans that account for high hazard areas and climate risks. Such plans need to be integrated throughout several government agencies and developed through consultative processes to include public participation. Based on hazard maps and projections of

climate change, plans could be designed to limit infrastructure and land uses based on vulnerability to both current climatic conditions and projected changes.

7.1.1.3 Develop and Implement Integrated Coastal Management Plans

Integrated Coastal management should be a priority for government agencies charged with land-use planning and natural resource management. Because coastal ecosystems can serve to buffer the impacts of climate variability and change on coastal infrastructure and land uses, national and local level management plans to conserve these ecosystems should be a top priority for adaptation. Ongoing efforts at integrated coastal management should include assessments of the potential impacts of climate change and sea level rise. These plans also provide a framework to balance resource allocation decisions across ministerial lines, because they seek to promote horizontal integration rather than the traditional vertical command and control decision-making process. Similarly, an important aspect of such plans will be the institutionalization of mechanisms for shared management responsibility between government and communities, which will encourage stakeholder participation in decision making processes.

7.1.1.4 Develop Coordinating Mechanisms to Ensure that Watershed Management Plans are Implemented at Both the Ministerial and Private Sector Levels

Many land use decisions in watersheds are not coordinated; as a result, land use practices are often a large source of sedimentation in coastal waters that limits the capacity of the coastal ecosystems to buffer storm surge and inundation. Land- use planning and natural resource management agencies should be encouraged to work with the various stakeholders in individual watersheds to plan uses that protect riparian forests and agricultural areas and to reduce or control sediment loads to coastal waters. Such plans could include zoning protection for vulnerable watershed areas.

7.1.1.5 Employ a "Retreat Approach" to Planning and Development in High Hazard Areas Along the Coastline

Land-use planning should encourage a strategic retreat from development and infrastructures in low-lying coastal floodplains and high hazard areas; planning and development would be based on retreat plans, where new structures are located on setback lines behind these areas. Designating a setback line begins with establishing a baseline, which could be drawn along the dune crest. For armored shorelines, the baseline may be drawn at the theoretical dune crest location -- the position where the dune crest was calculated to exist if the shoreline had not been armored. For most erosional beaches with a sand deficit, this theoretical dune crest location may be significantly landward of the seawall or bulkhead. For inlet zones, which are sections of beach in close proximity to tidal inlets, the baseline may be drawn at the most landward shoreline position at any time during the past 30 to 40 years.

Once the baseline is established a second line of jurisdiction, called the setback line, can be drawn. The setback line is intended to be a projection of where the baseline would be located in 30 to 40 years, landward from the baseline, at a distance equal to the average annual erosion rate multiplied by 30 to 40. For stable or accretion beaches with a zero rate, the setback line should be designed to give property owners reasonable use of their land, while at the same time restricting large commercial structures from the beach.

7.1.1.6 Integrate Regional Disaster Mitigation Strategies With National/Physical Planning

Historically development of physical and disaster mitigation plans has been done separately under different ministries with little or no integration. This also has been true in the United States: while the coastal management agency is commonly located in either natural resource management departments or the land-use planning agencies such as the state planning office, the state emergency management agency holds the lead for disaster response. Consequently, coordination and integration of these functions has developed slowly. However, such coordination of functions has facilitated improvements in planning and development by taking into consideration the need for improved building codes to reduce the loss of life and property; discouragement of development in high hazard areas, incorporation of a retreat policy and promotion of the use of soft structures to control erosion and flooding.

7.1.2 NEPA Climate Change Response Strategy

The National Environment and Planning Agency (NEPA) has proposed a set of response measures (see section 5.2) that will serve to guide the mainstreaming of climate change considerations into its strategic plans and programmes.

Institutional Arrangements and Implementation of the Strategy
NEPA's climate change response strategy provides the framework to support vulnerability reduction and natural resilience building as a proactive response to climate change, and recognizes the need for collaboration among Ministries, Agencies, Departments, NGOs, CBOs, academia and the private sector with NEPA playing the lead and coordinating role. Effective implementation of the strategy will require that the necessary actions are reflected in the Agency's Corporate and Operational Plans over the next five years.

The NEPA Climate Change Response Strategy 2010-2015 if fully implemented would effectively mainstream climate change considerations for the main policies and plans falling within the responsibility of NEPA.

7.1.3 Tourism Master Plan

The Tourism Master Plan did not provide for climate change or disaster planning. These deficiencies were addressed by the Vision 2030 Tourism Sector Plan. It is clear that the climate change could have a devastating effect on tourism and plans needs to be put in place to cushion the expected effects. The tourism sector must respond by planning strategically, and must make wise choices. There is a need to apply existing technologies to improve energy efficiency in order to respond to climate change. Vision 20/30 builds on the Tourism Master Plan in the development and implementation of the Tourism Sector Plan. Vision 2030 Tourism Sector Plan does effectively mainstream climate change in the tourism sector.

7.1.4 Vision 2030: Jamaica National Development Plan

Vision 2030 and the Sector Policies (see section 4.1) contain a comprehensive treatment of climate change issues. For example, at page 248 of Vision 2030 it is stated "If Jamaica is to move forward towards a sustainable future then effective measures will have to be taken to manage hazard risk ..... There is also an urgent need to incorporate climate change scenarios in future economic and land use planning".

7.1.5 National Forest Management and Conservation Plan

This Plan states that the FD will work with the GoJ, *"to develop policy support for Joint Implementation of carbon sequestration projects and encourage the involvement of the local private forestry sector and foreign companies."* The NFMCP does recognize that it is appropriate to protect closed broadleaf forest, reforest forest reserves, watersheds and privately owned forest land among other activities to offset GHG emissions from fossil fuels, but there was no policy to achieve this through carbon trading when it was prepared. It does not consider the other implications of climate change on forestry such as reduced rainfall, extended periods of drought, forest fires, elevated air temperatures, and increased incidents of pest and disease outbreaks. There is no mention of a plan to assess the vulnerability of forests to climate change or mitigation or adaptation activities.

7.2 Policy Framework

7.2.1 Draft Jamaica National Climate Change Policy and Action Plan

The Draft JNCCPA (2010) needs to be finalized and submitted for Cabinet approval as a matter of priority. The Draft JNCCPA once approved would establish the framework for mainstreaming climate change considerations in all areas of government. The

Draft JNCCPA contains strategies for specific sectors/resources including coastal and marine resources; terrestrial resources and terrestrial biodiversity; human settlement; tourism; financial sector; energy sector; agriculture sector; water resources; and health. A national climate change policy will promote integration between the programmes of the various government departments involved to maximize the benefits to the country as a whole, while minimising negative impacts. Further, as climate change response actions can potentially act as a significant factor in boosting sustainable economic and social development, a national policy specifically designed to bring this about is clearly in the national interest, supporting the major objectives of the government including poverty alleviation and the creation of jobs.

The JNCCPA suggests the creation of a National Climate Change Committee whose members will include government, academia and NGOs. Overall administrative responsibility will rest with the Ministry with responsibility for the Meteorological Service. The JNCCPA is comparable with similar policies in the Eastern Caribbean.

7.2.2 Agricultural Land Use Policy

The Agricultural Land Use Policy provides for the adaptation of climate smart farming techniques and choices as well as the exploration of accessible and affordable insurance and mitigation techniques to ensure sustainable farming. In addition the policy proposes that legislative amendments be undertaken to encourage improved land use through incentives and penalties to impact on land use and development activities. The Policy also calls for clear Agricultural Land Use Zoning/Districts.

The Policy deals with climate change and its impact on agriculture and points out that lack of planning to identify vulnerable areas and long term adaptation strategies to mitigate the magnitude of climate impacts will encounter heavy losses and greatly impact the government's budget and other developmental activities.

7.2.3 Forest policy

The Forest Policy is currently being revised and it incorporates climate change considerations such as to, "identify issues, needs and priorities for action in conservation of biodiversity in the context of climate change".

The NFA *"recognizes that climate change could have major impacts on the distribution and abundance of forest-dwelling species, the proliferation of pests and diseases, the frequency of storms and other extreme climatic events. The Agency recognizes the uncertainty associated with climate change and the subsequent need to conserve biodiversity in order to maintain resilience and to give forest systems the*

best possible chance of adapting to changing conditions. As such the National Forestry Agency will have a central role in climate change mitigation and adaptation planning. The National Forestry Agency shall plan with key Government agencies and non-governmental stakeholders a process to address climate change, adaptation and forestry issues in Jamaica. In an effort to increase the adaptive capacity of Jamaica to climate change, one strategy to be adopted is strengthening the capacity of forest dependent communities and industries. The Agency shall with other relevant Government Ministries and Agencies

- *Assess forest carbon stocks in both, biomass and soils and sequestration capacity.*
- *Plan and pilot adaptation initiatives on forest management taking into account the experiences and lessons learnt in the LFMCs.*
- *Develop closer relationships through LFMCs with forest-dependent communities so as to make them the centre of climate change adaptation efforts while strengthening their adaptive capacity and resilience."*

However, the Draft Forest Policy does not provide an analysis of the previous policy and the performance of the FD (now the NFA); or its previous reforestation and afforestation efforts, which since the country is already experiencing some effects of climate change could act as baseline data to help determine which tree species are the most hardy, the areas best suited for their growth, and the best time of year to plant out the seedlings. Neither does it state that it will conduct studies to determine which endemic trees are best adapted to cope with climate changes.

7.2.4 Wetland Policy

Wetlands are increasingly threatened by infrastructure development and conversion from natural habitat to other uses. There has also been the conversion of large tracts of coastal wetlands, particularly mangroves for commercial uses.

Widening and deepening of wetland areas has reduced the ecological value of these areas of slowing run-off of flood water. The unrestricted flow to coastal waters has led to an increase in peak fresh water flows to coastal areas contributing to the death of coral reefs. The impact of climate change has also compounded the likely effects on wetland areas.

There is no overarching and coherent policy framework for wetland management. A mangrove and coastal wetlands protection policy was prepared in 1996 but still remains in draft.

Wetland management in Jamaica is complicated by the fact that most wetlands are on private lands and the constitution allows private, landowners great latitude in the use and disposal of their property.

7.2.5 Ocean and Coastal Zone Management Policy

Given the critical importance of ocean and coastal zone areas and the significant impact that climate change will have on these areas the issue of climate change should be front and center in this Policy document - but it is not. Mention of climate change is absent from the Guiding Principles and forms no part of the central discussions of this Policy document. Although the Climate Change Convention and the Kyoto Convention are references in schedules to the document dealing with applicable international conventions, climate change forms no part of the text of the policy. It is therefore of critical importance that this Policy be revised to incorporate climate change considerations.

7.2.6 Towards a Beach Policy for Jamaica

The policy has as Objective 6, "Management of coastal resources in the light of their vulnerability to the effects of climate change and natural disasters." To address this, planning, zoning and development control within specified areas will be the main means of protection of coastal resources. The policy recommended that the Beach Control Act be amended to define the beach as, *"the zone of unconsolidated material (sand or gravel) that extends from the low water mark landward to the vegetation line, or to a line of debris deposited by wave action (usually the effective limit of storm waves), or a combination of such factors. It is further proposed that the declaratory amendment define a section between the foreshore and a distance of approximately 15m landward of the high water mark, which will be subject to regulatory control in order to provide for management of coastal zone resources."* The Beach Policy needs further revisions in order to effectively mainstream climate change. As the policy currently stands, it appears sea level rise due to climate change was not seen to be conclusive and the policy stated that an evaluation of the impact of sea level rise should be conducted. One aspect of climate change which was considered was beach erosion (although more information was needed about the causes and seriousness of coastal erosion) and management of the foreshore and beach was seen as the main means of protection of coastal resources. Adaptation strategies to be adopted and implemented are "protect, retreat and accommodate", and while "hard engineering will be encouraged, more emphasis will be placed on a precautionary or non-structural approach, which include[s]: increasing building setbacks, land use regulations, and building codes".

7.2.7 Draft Fisheries Policy

The draft Fisheries Policy does not incorporate climate change and this policy needs to be amended to mainstream climate change and its possible effects on marine habitats such as inundation of mangroves and coastal areas, bleaching of coral; and coastal/beach erosion which will affect fisherfolk villages. Neither is consideration given to fresh-water aquaculture and the possible impacts of climate change. The Draft policy notes that there has been an annual decline in marine fish catches harvested on the shallow shelf from 1986-1991 due to severe fishing pressures.

7.2.8 National Health Policy

While theme 6 of the outcome indicators of the Policy refers to disaster management, the Policy does not otherwise take into consideration the impact of climate change on health. The Policy should be revised to clearly enunciate the impact of climate change on health such as heat stress on the elderly, persons with cardiovascular problems; increases in vectors of disease such as mosquitoes, and rats.

7.2.9 National Land Policy

While the National Land Policy does acknowledge the need for the environment to be considered in development planning (disaster management), it does not incorporate climate change considerations such as where coastal lands are likely to be inundated; droughts; soil erosion; and saline intrusion of the coastal aquifers. While the policy acknowledges the need to properly plan settlements, infrastructure development, and land use planning, it does not consider the need to adapt to/or mitigate against climate changes. The Policy does note that squatters living in disaster prone or environmentally sensitive areas may need to be relocated; and it states that the GoJ will acquire lands when necessary for environmental preservation.

7.2.10 National Hazard Mitigation Policy

The National Hazards Mitigation Policy is adequate in terms of mainstreaming climate change.

7.2.11 Towards a Watershed Policy

The Watershed Policy does not reflect current climate change issues and therefore it will be of critical importance to amend and revise the Watershed Policy to mainstream climate change issues, namely increased droughts, changing

rainfall patterns and quantities, and saline intrusion. The policy does address watershed management, community participation, and financing.

7.2.12 Transport Policy

The National Transport Policy does not address climate change issues and does not deal with issues such as emissions and the impact of climate change on flooding and damage to roads.

Vision 2030 Transportation Sector Report points out that "the land transport sub-sector has contributed to increased consumption of fossil fuels and to long-term climate change. Increased paved roadway also increases surface water run- off, which tends to increase the degree of flooding resulting from hydrometeorological events. The road network is also vulnerable to damage caused by natural hazards particularly hurricanes, tropical storms and associated rainfall or flooding including sediment floods". Although the Vision 2030 Transportation Sector Report does remedy the shortfall in the Transport Policy dealing with climate change, the Sector Report is still inadequate in dealing with the responses necessary to build climate resilience.

7.2.13 Draft National Carbon Emissions Trading Policy

The Draft Carbon Emissions Trading Policy does mainstream climate change considerations and is adequate. The draft policy is to enable Jamaica's participation in the Clean Development Mechanism (CDM) of the Kyoto Protocol to the UNFCCC, and other carbon trading regimes. Eligible projects under the CDM fall under the following categories: energy efficiency, renewable energy, transportation, alternative fuels, land use, land use change, forestry, and waste-to-energy.

7.2.14 National Renewable Energy Policy

The Renewable Energy Policy recognizes the potential role of renewable energy with a portfolio of low carbon and cost competitive energy technologies capable of responding to the emerging challenges of energy security, climate change and access to energy.

7.3 NRCA Guidelines

The NRCA Guidelines for Environmental Impact Assessment, NRCA Guidelines for Development in the Coastal Zone of Jamaica as well as the NRCA Guidelines for the Planning, Construction and Maintenance of Facilities for Enhancement & Protection of the shorelines, need to be reviewed to effectively mainstream climate change considerations into these Guidelines.

7.4 Laws and Regulations

7.4.1 General

International environmental agreements and conventions do not have direct legal authority at the national level and must be locally implemented through national legislation within appropriate institutional structures. Legislation can be used to incorporate conventions either by repeating the conventional provisions, or by referencing the convention, sometimes by reproducing the agreement in an Appendix to the Act.

The Constitutions of the Jamaica (like most others in the Caribbean) do not provide citizens with an inherent fundamental human right to a clean and healthy environment as they focus more on civil and political rights. It provides strong protection to private property interests. While private property rights may be necessary to avoid "tragedy of the commons" environmental issues, private property interests may require curtailment in order to properly balance developmental and environmental concerns.

In the absence of constitutional protection of the right to a healthy environment, enactment of environmental legislation is under complete control of the government. While it is the government which is responsible for creating and adopting environmental laws, the Constitution enables the government to amend or repeal this very environmental legislation and Governments is often exempt from the scope of this legislation eg. the Housing Act and UDC operate outside the national planning framework as the Town and Country Planning Act and the Parish Councils Act do not bind the Crown.

There are many laws and regulations governing aspects such as land use and planning, protection of flora and fauna, fisheries, pollution of marine areas, beach protection, and public health. A range of institutions implements, monitors and enforces this environmental legislation. This fragmented approach can be considered an inadequate framework for environmental protection.

Over the years portfolio responsibility for environment management has shifted between different Ministries. The frequent reallocation of this portfolio in the past

has reduced the country's ability to implement a comprehensive environmental strategy.

Other institutions involved in environmental management in OECS countries

Notwithstanding the primacy of the ministries with responsibility for the environment, there are many institutions involved in issues relevant to environmental management. These institutions include government ministries, statutory bodies, NGOs and community groups. As found in most OECS countries, the general governmental institutions and their roles and responsibilities are outlined below.

- Ministries of Agriculture – responsible for land and marine-based natural resources, with departments that focus on forestry and fisheries;

- Land use and development authorities – responsible for regulating the use and development of land for urban, economic and infrastructural development;

- Ministries of planning – provides the lead in integration of planning activities;

- Ministries and agencies of public utilities and/or water – responsible for the provision of electricity, domestic water/sanitation as well as roads, drainage structures and dams; and,

- Ministries of health – responsible for environmental health, sanitation, liquid and solid waste management, water quality monitoring.

Currently, there are very few formal attempts to provide structured collaboration among these institutions at the national level within OECS countries. Most commonly collaboration occurs either informally at a personal level, or *ad hoc* through meetings or workshops dealing with specific issues. However, in the past ten years, activities associated with international environment-related conventions, such as biodiversity and climate change, have provided opportunities and resources for inter-ministerial and inter-agency discussions surrounding their proposed plans of action.

The following legislation will be required:

7.4.2 Building Code

It is of critical importance that the draft Building Code should be enacted in 2012.

Introduce national building codes that account for climate variability and change

Studies conducted worldwide have shown that strict adherence to building codes and standards reduce destruction caused by extreme weather events and climate variability. Revised building codes within individual countries could include instructions to (Vermeiren, 2000):

- Improve construction techniques such as stronger connections (at the ridge board, between the joists and the top plate, between the floor and the foundation, at the foundation footing), long screws/nails, hurricane straps and strong roofing materials;

- Modify engineering designs to include climate change projections, particularly for sea level rise, in addition to historical data typically used;

- Limit the siting of new structures in hazardous areas, restricting siting of any new public buildings in such areas;

- Elevate structures in high hazard areas (e.g., on pilings) through the designation of minimum floor elevations, piling depths and bracing requirements; and

- Add additional specifications to ensure that new buildings are built to better withstand wind and flooding.

In anticipation of warmer temperatures and prolonged periods of drought, buildings should incorporate features such as insulation in the roofs and walls; use of green roofs; and rainwater harvesting.

It is important to include training programs in code requirements and construction techniques for local builders and carpenters, including the informal housing community. Strengthened building codes are of little use if they are not properly enforced; therefore, any efforts to revise codes or implement new ones should also include training programs for building inspectors.

7.4.3 Town & Country Planning Act

A new Town and Country Planning Act is needed to improve the planning process, strengthen the planning framework and incorporate climate change factors in the planning process. Specifically it will be necessary to ensure that the criteria for the design and construction of infrastructure including permitted activities such as coastal protection structures (groynes, break waters and sea walls) are adequate to withstand the impact of climate change.

- Promulgate Development Orders.
- Introduce regulations to phase out development in high hazard areas

In addition to revised building codes for the quality and siting of new structures, regulations should be introduced to plan a strategic retreat of existing development located in low-lying coastal floodplains and high hazard areas along the coast. These regulations should consider:

- Prohibiting the construction of protective structures in sensitive high hazard areas;
- Prohibiting the reconstruction of storm-damaged property in high hazard areas; and
- Conditioning land ownership in high hazard areas to expire when a property owner dies or when sea levels reach a particular point along a map.

7.4.4 Environmental Management Act

A new comprehensive and updated Environmental Management Act is needed. The new Environmental Management Act will update the existing NRCA Act and also reflect climate change considerations. The Natural Resources (Prescribed Areas) (Prohibition of Enterprise, Construction and Development Order 1996 and the Natural Resources (Permits and Licences) Regulations should be revised to specifically include climate change considerations. Thus climate change considerations should be explicitly integrated in the EIA process.

7.4.5 Meteorological Act

A new Meteorological Act is needed to place the Meteorological Department on a statutory footing
and it would also set out the objectives and functions of the Weather Servic e. It would empower the
Jamaica Weather Service to provide advisory service to
the Government as well as commercial services to the private sector.

7.4.6 Disaster Management Act

The draft Disaster Management Act is geared towards strengthening areas in need of immediate attention. These include:

- Legal recognition of existing organizational structures such as the National Disaster Committee, the Parish Disaster Committees and the Zonal Committees with their roles and functions clearly established;
- Legal establishment of a National Disaster Fund;

- Identification and description of high-risk areas as “special vulnerable areas” and the necessary action to be taken in respect of such areas;

- Evacuation of persons identified to be at risk as a prevention measures.

7.4.7 Development Orders

Finalization and promulgation of the Development Orders and Development Plans for Kingston and St. Andrew, Manchester, Santa Cruz and Negril whilst ensuring that climate change mainstreamed into these Orders and Plans. As regards existing Development Orders and Plans there need to be revised to ensure that they reflect climate change considerations.

7.4.8 Renewable Energy Act

The development and finalization of a Renewable Energy Act is necessary. This will provide the enabling environment for greater use of renewable energy sources and energy efficiencies;

7.4.9 Conversion of Prime Lands to Non-Farm Uses

Establish legislation to include levying a prohibitive tax on the conversion and subdivision of prime lands to non-farm uses without approval.

7.4.10 Agricultural Zoning Orders

NEPA in collaboration with Parish Councils and the Ministry of Agriculture will prepare Agricultural Zoning Order/Districts as a technique for protecting prime agricultural lands.

7.4.11 NEPA

- Finalize the draft Natural Resources (Portland Bight Protected Area) Regulations;

- Review and amend the Natural Resources (Air Quality) Regulations, 2006;

- Review and revise the Natural Resources (Montego Bay Marine Park) Order & the Natural Resources (Marine Parks) Regulations;

- Review and revise the Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development Order) 1996 and the Natural Resources (Permits and Licences) Regulations

7.4.12 Watershed Protection Act

The Watershed Protection Act has not benefitted from any substantial revision since its promulgation in 1963 and may be considered outdated in respect of the participatory approach currently being utilized in watershed management, institutional arrangement, and fines to name a few. The Act relies heavily on prohibiting and regulating to protect the declared watersheds and lacks provision for incentives, public education and the involvement of local communities.

A new Act is needed in which there is new thinking and approaches to watershed management, which addresses crucial institutional and legal issues, and which provides a solid legal basis for the conservation and development of Jamaica's watershed resources.

8 Identification of Areas for Priority Attention in the Short or Medium Term

There are a number of key areas that require priority attention in the short or medium term. These may be broken down into institutional, policy, plans and legislative measures.

8.1 Institutional

It will be of critical importance to create a Climate Change Unit so as to facilitate the coordination of all climate change activities across all aspects of Government in Jamaica. In addition a number of existing agencies need to be strengthened. These include NEPA, the Water Resources Authority, ODPEM, and the Met. Office (see Appendix 1 for details). Figure 3 shows the functional operational components for a climate change unit.

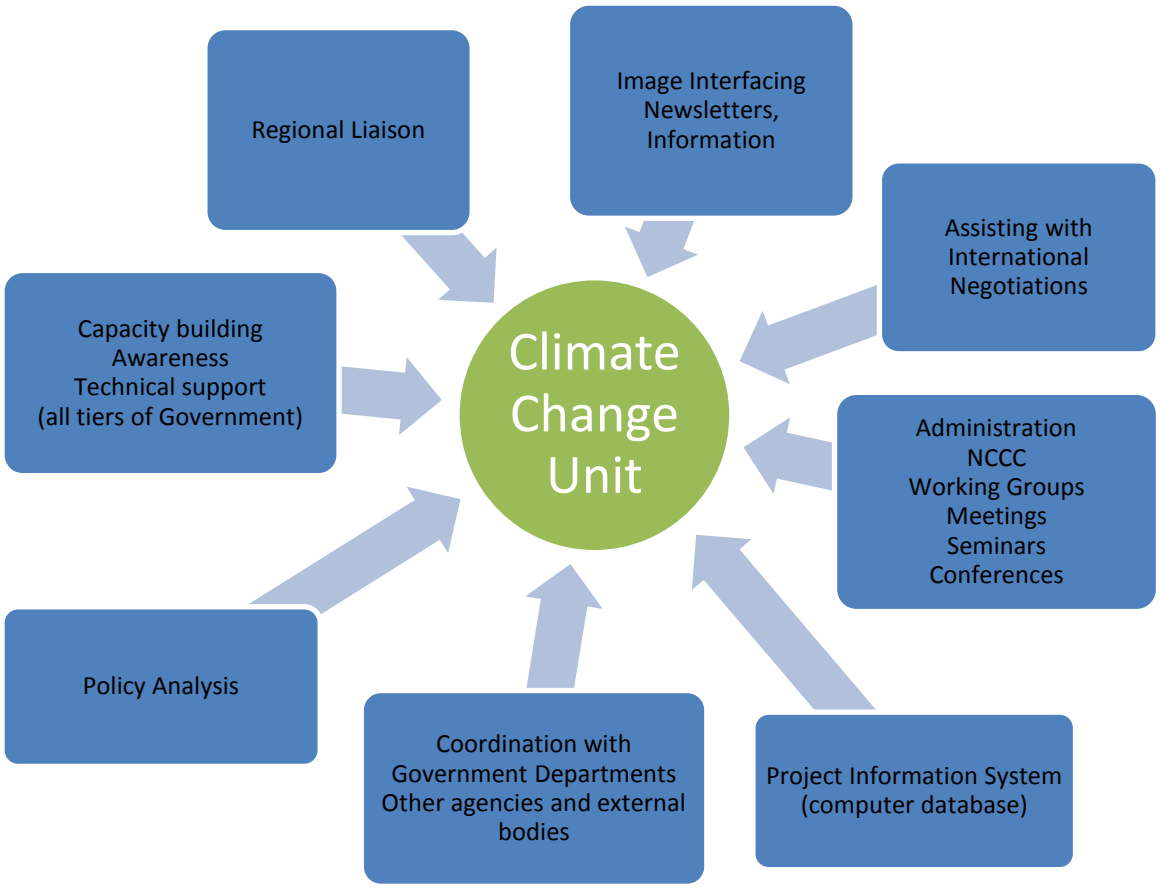

Figure 3. Functional Operational Components for Climate Change Unit

8.1.1 Public-Private Linkages

Clearly climate change mitigation and adaptation are not the sole preserve of governments, as most activities which impact on the climate or, in turn, are impacted by a changing climate take place in civil society. Many promising climate change responses, especially in relation to mitigation, will involve the private sector, such as energy efficiency gains in industry, retrofitting buildings to conserve energy, and renewable energy providers. Governments can assist the private sector in taking up these activities through various incentives, through green procurement, and through public-private partnerships. Governments can also involve the private sector through multi-stakeholder processes and consultations, as well as adding private sector representatives to key committees and national councils.

One key area where private sector involvement is essential is in amendments to national codes and standards, such as the engineering standards, building codes, or hurricane proofing standards. Often the best method is for the Government to set a specific target and request the private sector to find the best ways of achieving that target. Standing committees may be formed to regularly review such standards and codes as additional information on climate change predictions becomes available.

At the community level, NGOs have proven to be effective intermediaries between the government and the community. Governments should encourage active civil society involvement in all areas of climate change responses. Local and international NGOs may be particularly helpful in documenting and codifying traditional and indigenous adaptation measures, which may hold the key to future adaptation measures. Environmental NGOs can contribute considerable experience in ecosystem-based approaches to climate change adaptation to facilitate less vulnerable and more resilient communities.

8.2 Policy

The existing Water Policy needs to be revised to include climate change considerations. In addition the mandates of both NWC and WRA should include climate change since extremes in climate can lead to droughts. Recommendations for NWC and WRA were made in the Strategy and Action Plan outlined in Development of a National Water Sector Adaptation Strategy to Address Climate Change in Jamaica (ESL, 2008), however, the forecasts were generalized, more focused studies are being undertaken by the Climate Studies group at the University of the West Indies Mona Campus which will help to provide more accurate forecasts.

It is understood that the Forest Policy is currently being revised and the expectation is that climate change considerations will be incorporated into the revised policy.

8.2.1 NEPA Policies

NEPA's Climate Change Response Strategy 2010-2015 calls for all environmental and planning policies, strategies and plans to include climate change considerations.

In respect of NEPA a number of policies will need to be updated to effectively mainstream climate change considerations. These include the Ocean and Coastal Zone Management Policy, the Mangrove and Coastal Zone Wetlands Protection Policy, Towards a Beach Policy for Jamaica (A Policy for the use of the Foreshore and the Floor of the Sea), the Coral Reef Protection and Preservation Policy and Towards a Watershed Policy for Jamaica.

8.3 National Spatial Plan

The National Development Plan - Vision 2030 Jamaica provides a framework for the transformation of the Jamaican society and economy by 2030. The Plan identifies long term sector strategies and priorities. The achievement of the national goals is dependent on the existence and effective operation of an appropriate spatial framework. The National Spatial Plan (NSP) will therefore provide the strategic spatial framework to guide national development and investment decision making. The Plan will ensure the optimal use of the nation's land and marine resources and outline the framework for their effective use and management. The NSP will therefore provide a framework that:

1. Coordinates policies with a spatial dimension and align strategic investment priorities;

2. Builds safer, stronger and healthier communities, and a better quality of life;

3. Addresses the major challenges of global competition, disaster risk reduction and climate change response, while protecting the environment, improving natural resources management and enhancing the quality of the built environment;

4. Identifies priorities and opportunities to promote development which will help to regenerate communities and enable disadvantaged communities to access opportunities;

5. Identifies priorities for the improvement of infrastructure to support long term development that promote more sustainable patterns of transport and land use; and

6. Provides recommendations for institutional and administrative support necessary for all levels of the spatial planning hierarchy to facilitate a more integrated planning and development process, and one which is more inclusive and participatory.

The National Spatial Plan will provide the strategic framework necessary to underpin and guide national spatial development and investment decision making. The NSP will, *inter alia*, provide the spatial framework for guiding the location and regulation of orderly and progressive development, establishing broad based policies governing development activities contained in Vision 2030, Jamaica National Development Plan and other public and private sector initiatives. THE NSP when completed, will be a critical instrument of support for the long-term strategy to improve the overall development planning process including environment and natural resources management as well as contribute to mainstreaming climate change.

Preparation of the NSP will thus help Jamaica to-

- Establish the framework to guide/inform spatial development at the regional and local level;

- Optimize the use of land and natural resources for sustainable development;

- Facilitate balanced development;

- Ensure that land resources are used in the public interest;

- Achieve one of the desired outcomes of Vision 2030 which is to create and appropriate framework for sustainability planning.

To ensure the preparation of the Plan, The Government of Jamaica (GOJ) sought and received a Grant from the Caribbean Development Bank (CDB) to assist in meeting the costs of consultancy services required for the preparation of the Plan. The Project is being implemented by the Office of the Prime Minister (OPM) with full time technical support from the National Environment and Planning Agency (NEPA).

8.3.1 Setbacks Guidelines

The current published setback guidelines need to be revised. Instead of being based on slope angles these should be related to local risk from present and future storm

events, thus they should be site specific. Setbacks for structures on rocky coasts where there is storm deposited debris should be determined by the position of the debris ridge formed by sandy and rocky debris accumulated over a long period.

8.4 Legislation

At present the current policy and legislative framework is not adequate to respond to the ongoing requirements of climate change. Legislative measures required include:

- A new Watershed Protection Act needs to be enacted since it is a critical component of climate change.

- A new Town and Country Planning Act specifically it will be necessary to ensure that the criteria for the design and construction of infrastructure including permitted activities such as coastal protection structures (groynes, break waters and sea walls) are adequate to withstand the impact of climate change;

- Water Resources (Amendment) Act (Draft) is to be finalized to transfer power of flood water planning to the Water Resources Authority;

- Finalization and promulgation of the Development Orders and Development Plans for Kingston and St. Andrew, Manchester, Santa Cruz and Negril whilst ensuring that climate change is mainstreamed into these Orders and Plans. As regards existing Development Orders and Plans there need to be revised to ensure that they reflect climate change considerations.

- A new Environmental Management Act that will update the existing NRCA Act and also reflect climate change considerations. The revision of the Natural Resources (Prescribed Areas) (Prohibition of Enterprise, Construction and Development Order 1996 and the Natural Resources (Permits and Licences) Regulations to specifically include climate change considerations. Thus climate change considerations should be explicitly be integrated in the EIA process;

- A new Disaster Management Act should be finalized and enacted as a matter of priority;

- Finalization and implementation of the Fisheries Bill

- The finalization and enactment of a Metereological Act will be critical component for enhancing their powers for the effective management of climate change;

- The development and finalization of a Renewable Energy Act is necessary. This will provide the enabling environment for greater use of renewable energy sources and energy efficiencies;

- Establish legislation to include levying a prohibitive tax on the conversion and subdivision of prime lands to non-farm uses without approval.

- Enact a National Building Act (see below discussions and recommendations) re the Building Code;

- Housing Act

  Amend the Housing Act to make the Housing Act subject to planning approval requirements under the Town and Country Planning Act.

- Urban Development Corporation Act

  Amend the Urban Development Corporation Act subject to planning approval requirements under the Town and Country Planning Act.

NEPA in collaboration with Parish Councils and the Ministry of Agriculture will prepare Agricultural Zoning Order/Districts as a technique for protecting prime agricultural lands.

- Finalize the draft Natural Resources (Portland Bight Protected Area) Regulations;

- Review and amend the Natural Resources (Air Quality) Regulations, 2006;

- Review and revise the Natural Resources (Montego Bay marine Park) Order & the Natural Resources (Marine Parks) Regulations;

- Review and revise the Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development Order) 1996 and the Natural Resources (Permits and Licences) Regulations.

8.4.1 Enact National Building Act and Promulgate New Building Code

The enactment of a National Building Act and the promulgation of a Building Code should be accorded high priority.

The new Building Code will be the first comprehensive modern Building Code for Jamaica intended for use in the regulation of the building construction section with the primary aim of improving safety against natural and man-made perils. The Code also places emphasis on energy conservation. The new Building Code will also assist in mainstreaming climate change considerations in that it will take into account factors which are indigenous to Jamaica eg. weather conditions.

A National Building Act is the underpinning legislation required to give Authority to the Building Code. Without a National Building Act, the Building Code cannot be legally enforced and thus would only be an optional code.

The new Building Code would also prohibit persons from building in areas that are prone to disaster. The new Building Code also seeks to provide for greater level of safety in light of increased threats from man-made and natural phenomena. All material inputs will be required to comply with their appropriate standards. Materials include roofing materials, cement, blocks, concrete etc.

8.4.2 Prioritization of Legislation

In terms of priority the following legislation needs to be enacted during the 2012-2013 legislative agenda:

2012-2013

- Water Resources (Amendment) Act
- Disaster Management Act
- Town and Country Planning Act
- Meterological Act
- National Building Act and promulgation of the Building Code
- Renewable Energy Act

2013-2014

- Natural Resources (Air Quality) Regulations
- Natural Resources (Portland Bight (Protected Areas) Regulations)
- Agricultural Zoning Orders
- Finalization and promulgation of Development Orders for Kingston and St. Andrew, Manchester, Santa Cruz and Negril
- Environmental Management Act
- Amended Natural Resources (Prescribed Areas) (Prohibition of Enterprise, Construction and Development Order)
- Amended Natural Resources (Permits and Licences) Regulations

9 Human and Financial Resources to Incorporate Climate Change Concerns in Development Policies, Plans, Regulations and Legislation

A number of key agencies need to be strengthened to effectively incorporate climate change concerns. Among these agencies are the Meterological Department, the Water Resources Authority, NEPA, ODPEM, and the Ministry of Agriculture. Appendix 1 contains a more detailed framework of the resources required.

Since climate change affects everyone there should be capacity building of NGOs, and community groups.

APPENDIX 1

Strategy and Plan of Action

RECOMMENDATIONS	TIMEFRAME	FUNDING		RESPONSIBLE AGENCIES
		Amount (USD)	Source	
Capacity (Technical)				
• Introduce environmental economic principles to assist with climate change adaption programme and policy development	Short-term	T.D.B	CCCCC/G.E.F/UNDP/UNEP	GoJ/Universities
• Commission a comprehensive study on the likely impact of climate change on the economy. It could be informed by the Stern Review on the Economics of Climate Change report done for the British Government by Lord Stern in 2006.	Short term	$929,300. Based on 30 professional person months @$17,600/pm and associated direct costs at 60% plus 10% contracting costs.	Bilateral or Multilateral sourcing	PIOJ
• A Joint GoJ/Private Sector Rehabilitation and Development Program. For main irrigation crops the reintroduction of water harvesting, use of	Short term	$1.5M per year for the first 2 years	GoJ and private sector	Ministry of Agriculture

RECOMMENDATIONS	TIMEFRAME	FUNDING		RESPONSIBLE
alternative water sources such as treated sewage effluent and crop production efficiency including drought resistant crop modification.				
• Improvement in response systems for recovery assistance and its distribution to farmers arising from weather threats.	Immediate and ongoing	T.B.D.	GoJ with Bi and Multilateral assistance	ODPEM & Ministry of Agriculture
• Technical assessment of the use of aquifer recharge to act as barrier to saline intrusion.	Short term	$250,000	GoJ	WRA
• Engagement of main stakeholders in areas such as plant breeding, agrochemicals and fertilizers, irrigation and agricultural equipment etc. on the implications of climate change.	Short term	$50,000 To fund a series of sector specific consultations	GoJ	PIOJ
• Continue and strengthen broad range of sustainable development initiatives so as to protect environmental flows.	Immediate and ongoing	T.B.D.	CCCC/G.E.F./UNDP/UNEP GoJ	PIOJ
• Stricter enforcement of physical planning laws and regulations is				

RECOMMENDATIONS	TIMEFRAME	FUNDING		RESPONSIBLE
also necessary to ensure that life and property is not placed at risk from both pluvial, fluvial and coastal flooding and flood events.				
Capacity (Institutional)				
• Vigorously enforce existing physical planning laws.	Immediate & ongoing	Minimal	NEPA/PCs	NEPA/PCs
• Establish Water Sector Task Force to develop and promote IWRM in Jamaica	Immediate	Minimal	Across stakeholders	WRA, NEPA, FD, NIC, NWC, Universities, PCs, Private Sector.
• Promote training and career development for water professionals in Jamaica.	Immediate & Ongoing	Minimal	GoJ, UWI, JIE	GoJ, Universities, JIE, WRA, NWC, NIC, FD etc.
• Strengthen NEPA's/PCs ability to enforce planning requirements especially coastal zone protection measures.				
• Get Parliamentary approval of WRDMP – as mandated by 1995 Water Resources Act.	Short term	Minimal	N/A	Ministry of Water, Land, Environment and Climate Change
• Water managers should take climate change forecasts (1-3 months ahead) into account in	Ongoing	T.B.D.	Ministry of Water and Housing, NWC, WRA	Climate studies group, Mona, Met Office and Carib.

RECOMMENDATIONS	TIMEFRAME	FUNDING		RESPONSIBLE
planning.				Inst. Met & Hydro.
• Strengthen the Meteorology Services by providing additional staff and where necessary technical expertise to deal with climate change matters, establish a Research and Development Unit & strengthen administrative systems (accounting & human resources)	Short term	T.B.D	GEF/GoJ	Met. Service, ODPEM, OPM
• Strengthen the ODPEM to deal with new issues emerging from climate change.	Short term	T.B.D.	GEF/GoJ	Met. Service, ODPEM, OPM
• Strengthen the Water Resources Authority to deal with new issues emerging from climate change.	Short term	T.B.D.	GEF/GoJ	Met. Service, ODPEM, OPM
• Clarify agency responsible for planning for coastal works (including beach and shoreline erosion).	Short term	T.B.D.	GEF/GoJ	Met. Service, ODPEM, OPM
• Strengthen the proposed Climate Change Unit	Long term	T.B.D.	GoJ	Ministry of Water, Land, Environment and Climate Change

RECOMMENDATIONS	TIMEFRAME	FUNDING		RESPONSIBLE
• Workshops for building public awareness among NGOs, community groups, and civil society	Long Term	T.B.D.	GoJ	Ministry of Water, Land, Environment and Climate Change
Plan				
• Develop and finalize National Spatial Plan.	Immediate	T.B.D.		PIOJ, WRA, NEPA, PCs, Ministry of Water, Land Environment & Climate Change.
• Revise NRCA Guidelines for Environmental Impact Assessment.	Medium Term	$30,000		NEPA
• Revise NRCA Guidelines for Development in the Coastal Zone of Jamaica.	Medium Term	$30,000		NEPA
• Revise NRCA Guidelines for the Planning, Construction and Maintenance for Facilities for the Enhancement & Protection of the Shorelines.	Medium Term	$30,000		NEPA
Policy				
• Revise Water Sector Policy to mainstream adaptation mechanisms regarding Climate Change.	Immediate	$75,000 (100 person days)	GEF	Ministry of Water, Land Environment & Climate Change, WRA

RECOMMENDATIONS	TIMEFRAME	FUNDING		RESPONSIBLE
• Need to get out message of climate change impacts to all sectors, not just the water sector. Similarly other sectors should take scenarios of climate change into consideration when doing adaptation studies, as was done with the ESL Water project.	Immediate	T.B.D.	UNDP	Ministry of Water, Land, Environment & Climate Change.
• There needs to be a link between the climate change policy and the water policy.	Immediate	T.B.D.	GEF	Ministry of Water, Land, Environment and Climate Change
• Review and revise the Coastal Zone Policy	Immediate	$100,000	GEF	NEPA
• Revise the Watershed Policy to take into account climate change considerations.	Immediate	$30,000	GEF	WRA/FD, NEPA
• A climate change policy be developed by the Government and be presented to Cabinet for approval.	Immediate	$100,000 consultancy fees & consultation costs & document preparation	MoW&H	Ministry of Water, Land, Environment and Climate Change, WRA
Legislation				
• Establish legislation to include	Short term	$30,000	GoJ	NEPA, Parish

RECOMMENDATIONS	TIMEFRAME	FUNDING		RESPONSIBLE
levying a tax on the conversion and the subdivision of prime lands to non-farm uses without approval.		consultancy fees		Councils, RPPD
• Prepare Agricultural Zoning Orders/destructs for protecting prime agricultural land	Short term	$30,000 consultancy fees	GoJ	NEPA
• Ensure "climate change" friendliness in new legislation being prepared regarding Flood Control.	Immediate	$20,000	MoW&H	Ministry of Water, Land, Environment and Climate Change, WRA
• Finalize Draft Disaster Management Act.	Short term	$30,000 consultancy fees and consultations	GEF	AGD
• Proposals for the enactment of a Meteorological Act be implemented.	Short term	$50,000	GEF	AGD
• Building Code enactment	Short term	US$50,000 consultancy fees	GEF	AGD
• Town & Country Planning Act	Short term	US$50,000 consultancy fees	GEF	AGD
• Environmental Management Act drafting and finalizing	Short term	US$75,000 consultancy fees & costs of	GEF	AGD

RECOMMENDATIONS	TIMEFRAME	FUNDING		RESPONSIBLE
		consultations		
• Renewable Energy Act drafting and finalizing	Short term	US$75,000 consultancy fees & cost of consultations.		AGD
• Finalize the draft Natural Resources (Portland Bight Protected Area) Regulations, 2006.	Short term	US$20,000 consultancy fees	GoJ	NEPA
• Revise Natural Resources (Air Quality Regulations, 2006	Short term	$30,000	GoJ	NEPA
• Revise the Natural Resources (Montego Bay Marine Park) Order & the Natural Resources (Marine Park) Regulations	Short term	$35,000 consultancy fees & costs of consultation	GoJ	NEPA
• Review and revise the Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction & Development Order), 1996 and the Natural Resources (Permits and Licences) Regulations	Short term	$50,000 consultancy fees & costs of consultations	GoJ	NEPA

Ongoing	Immediate	Short term = 1-3 yrs	Medium = 3-5 yrs	Long term = >5

APPENDIX 2

Adequacy or Inadequacy of New and Existing Policies, Plans, Guidelines, Laws and Regulations for Addressing Climate Change

	Policy/Plan/Guideline /Law and Regulation	Adequate		What Needs to be Done
		Yes	No	
New/Draft Policies/ Plans/ Guidelines/ Laws and Regulations	Jamaica Climate Change Policy and Action Plan	X		To be finalized. The draft as reviewed still has areas for information to be included.
	Draft Plant Health Policy		X	Integrate strategies to combat possible infestations caused by climate change; and climate change mitigation and adaptation strategies.
	Draft Food and Nutrition Security Policy	X		
	Jamaica Renewable Energy Policy - Draft	X		
	Draft Carbon Emissions Trading Policy	X		Policy developed to fulfill Jamaica's commitment to UNFCC
	Mangrove and Coastal Wetlands Protection – Draft Policy and Regulations		X	Revise to mainstream climate change considerations. However, this will be subsumed into the National Coastal Resources Policy.
	National Policy for the Conservation of Seagrasses		X	Revise to mainstream climate change considerations
	Towards A Beach Policy for Jamaica (A policy for the Use of the Foreshore and the Floor of the Sea) November 2000 (Draft)		X	Revise to include climate change considerations
	Draft Mariculture		X	Revise to mainstream

	Policy/Plan/Guideline	Adequate		What Needs to be Done
	Policy			climate change considerations
	Draft Fisheries Policy		X	Revise to mainstream climate change considerations
	The Natural Resources Conservation (Portland Bight Protected Area) Regulations 2000 (Draft)		X	Regulations needs to be revised and implemented.
	Draft Fisheries Bill	X		Draft Fisheries Bill needs to be finalized and implemented.
	Disaster Management Act 2009 (Draft)	X		
Existing Policies/ Plans/ Guidelines/ Laws and Regulations	Agricultural Land Use Policy	X		
	Organic Policy		X	
	Jamaica National Energy Policy	X		
	National Transport Policy		X	Does not address climate change issues, nor emissions and the impact of climate change on flooding and damage to roads.
	Integrated Solid Waste Management Policy		X	
	Policy on Environmental Stewardship of Government Operations		X	Policy needs to be revised
	Ocean and Coastal Zone Management Policy		X	Need to integrate climate change considerations
	Coral Reef Protection		X	Need to integrate climate

Policy/Plan/Guideline	Adequate		What Needs to be Done
and Preservation Policy			change considerations. However this will be subsumed into the National Coastal Resources Policy.
Forest Policy, 2001		X	Forest Policy is being revised and it is understood that climate change considerations will be in the revision
National Health Policy		X	Need to be revised
Policy for Jamaica's System of Protected Areas		X	Mainstream climate change considerations
Jamaica Water Sector Policy, Strategies and Action Plan		X	Water Sector Policy needs to be revised
Towards a Watershed Policy for Jamaica		X	Watershed Policy needs revision
The National Hazard Mitigation Policy and National Response Matrix	X		
Vision 2030 Jamaica: National Development Plan	X		
Agriculture Sector Plan	X		
Jamaica National Environmental Action Plan		X	Needs to integrate climate change considerations
National Biodiversity Strategy and Action Plan	X		
National Forest Management and Conservation Plan		X	Review for inclusion of climate change considerations
Strategic Forest Management Plan		X	Review for inclusion of climate change considerations
National Spatial Plan			This is to be developed
Master Plan for Sustainable Tourism		X	Mainstream climate change considerations

Policy/Plan/Guideline	Adequate		What Needs to be Done
Development			
NRCA Guidelines for the Deployment of Benthic Structures		X	Review
NRCA Guidelines for Environmental Impact Assessment (1998)		X	Mainstream climate change considerations
NRCA Guidelines for Development in the Coastal Zone in Jamaica (1998)		X	Integration of climate change considerations.
NRCA Guidelines Pertaining to Marinas and Small Craft Harbors		X	Integration of climate change considerations
NRCA Guidelines for the Planning, Construction and Maintenance of Facilities for Enhancement and Protection of Shorelines		X	Mainstream climate change considerations
Natural Resource Conservation Authority Act		X	A new Environmental Management Act is needed
National Health Policy		X	While disaster management is mentioned the broader issues related to climate change are not considered
Natural Resources Conservation Authority (Air Quality) Regulations, 2006 (hereinafter referred to as the Air Quality Regulations)		X	These Regulations need to be revised
The Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise,		X	Integration of climate change considerations needed

	Policy/Plan/Guideline	Adequate		What Needs to be Done
	Construction and Development) Order, 1996 and The Natural Resources (Permits and Licenses Regulations)			
	Beach Control Act, 1956		X	Act needs to be revised
	The Fishing Industry Act, 1975		X	A new Fishing Bill is in preparation
	The Forest Act, 1996	X		
	Forest Regulations	X		
	The Office of Disaster Preparedness and Emergency Management Act (1998)		X	New Act is needed – a draft is in existence
	Town and Country Planning Act, 1957 (Amended in 1999)		X	New Act is needed
	The Town and Country Planning Coast Confirmed Development Orders		X	New Act is needed
	Land Development and Utilisation Act (1966)		X	Decision needs to be taken on usefulness of this Act
	Local Improvements Act (1914)		X	Act needs to be revised
	The Housing Act (1969)		X	Amend to make this Act subject to the Town & Country Planning Act
	Water Resources Authority Act, 1995			
	Watershed Protection Act, 1965		X	Revise to incorporate climate change considerations
	Urban Development Corporation Act		X	Amend to make this Act subject to the Town and Country Planning Act

APPENDIX 3

Summary of Climate Change Issues

SECTOR	IMPACT	ADAPTATION MEASURES
Coastal and Marine Resources	Destruction of reefs, increased erosion of beaches, damage to low-lying and coastal areas, towns, roads and property infrastructure as a result of increased frequency, and intensity of hurricanes.	• Undertake public awareness campaign to educate the population about the potential impact of climate change and climate variability on the coastal and marine environment. • Identify cost effective measures to protect and or reduce the damage to the coastal environment, including coastal infrastructure and coastal near-shore ecosystems.
Agriculture and Forestry	Reduced production and decrease in soil productivity as a result of less rain and drought.	• Undertake public awareness campaign to educate the population about the potential impact of climate change and climate variability on Agriculture and Forestry. • Identify and adopt appropriate Methods of technology to facilitate the introduction of drought resistant crops. • Promote the maintenance of forested and green areas as a buffer to the negative effects of climate change.
Water Resources	Negative impact on the generation of hydroelectricity and potable water as a result of adverse changes in the rainfall pattern, landslides and increased soil erosion.	• Undertake comprehensive inventory of all water resources including surface and ground water. • Identify cost effective methods to increase water recovery.
Human Settlement	Impact on settlement patterns and building design.	• Develop a comprehensive land use planning and management plan. • Develop a disaster management plan.

SECTOR	IMPACT	ADAPTATION MEASURES
Socio/Economic Development	Increased costs to the financial sector including the banking and insurance sector.	• Facilitate the availability of cost effective insurance and reinsurance to aid affected areas, in order to rebuild and restore infrastructure. • Adopt "risk management" techniques as a tool that can be applied in the design and selection of strategies for coping with the uncertainty of climate change.
Tourism	Damage to tourism infrastructure located in coastal areas and coastal ecosystems such as coral reefs, as a result of storm surges.	• Undertake public awareness campaign to sensitize individuals about the potential impact of climate change and climate variability on Tourism. • Adopt appropriate technologies and develop policies to promote water conservation, the use of renewable energy and the management of both solid and liquid wastes in the Tourism Industry.
Human Health	• Increase incidence of heat stress and related injuries. • Increase in vector and water borne diseases as a result of increased temperature and precipitation.	Undertake public education and training program to increase awareness about the potential impact of climate change and climate variability on health.

APPENDIX 4

Climate Change Impacts and Possible Adaptation Measures

Climate Impacts	Possible Adaptation Measures
Tropical cyclones	Cyclone-proofing of buildings Insurance to transfer risk Window shutters; tree-trimming Warning system in place and preparedness, eg. evacuation plan, storage of supplies Early warning option to use text messaging (e.g. Lime and Digicel)
Coastal erosion and beach loss	Erosion control (preferably through soft engineering and environmental conservation measures and avoiding hard structures) Beach nourishment Mangrove rehabilitation Use traditional knowledge and practices Diversify tourism product away from "the beach", e.g. ecotourism/cultural tourism
Coral reef bleaching	Conserve reefs and enhance their resilience through: Reduction of water pollution (sewage treatment) Mangrove rehabilitation to reduce sedimentation Controlling outbreaks of pests – e.g. crown of thorns starfish (tourist participation)
Reef damage (erosion)	Traditional tabu (reserve) systems to allow reef regeneration Environmental practices in diving, snorkeling and boating activities
Sea level rise	Setting back of structures
Sea flooding and storm surge	Setting back of structures, sufficient height of buildings Natural shelter belt (e.g. coconut trees) Enforce the 30 m set-back
River flooding	Drainage improvement; dredging Land use plans
Landslides	Erosion control (e.g. reforestation) Drainage control
Droughts and water shortage	Rainwater storage facilities (esp. outer islands) Water conservation (e.g. guest education, water-saving devices, reusing of waste-water), compost toilets (instead of flush toilets)

Wildfires	
Thunderstorms (causing power blackouts)	
Health Dengue fever outbreaks Bacterial Filariasis Respiratory diseases	Eradication programmes Control of breeding grounds Hygienic standards (e.g. water storage)

APPENDIX 5

Persons Consulted

Mr. Basil Fernandez	WRA
Mr. Jeffrey Spooner	Meterological Services
Mr. Clifford Mahlung	Meterological Services
Mr. Andre Kong	Fisheries Division
Miss Leonie Barnaby	Ministry of Water, Land, Environment and Climate Change
Miss Marsha Martin	Ministry of Water, Land, Environment and Climate Change
Ms. C. Bernard	PIOJ
Mr. Daley	PIOJ
Mr. Petersen	PIOJ
Mr. Vidal Rainford	Ministry of Energy
Dr. Marc Panton	Ministry of Agriculture

REFERENCES

Ahmad, Rafi, and James P. McCalpin. *Landslide Susceptibility Maps for the Kingston Metropolitan Area, Jamaica with Notes on Their Use*. Rep. no. UDS Publication No. 5. 1999. *OAS.org*. Organization of American States. Web. 24 Jan. 2012. <http://www.oas.org/cdmp/document/kma/udspub5.htm>.

Akegbejo-Samsons, Yemi. "Climate Change Impacts on Fisheries Production in Land-water Interface." *Riversymposium.com*. River Symposium, 2008. Web. 9 Jan. 2012. <http://www.riversymposium.com/index.php?element=AKEGBEJO-SAMSONS>.

Atherholt, T. B., M. W. LeChevallier, and W. D. Norton. "Effect of Rainfall on Giardia and Cryptosporidium." *Journal of the American Waterworks Association* 90.9 (1998): 66-80. Print.

Australia. Environmental Defender's Office NSW. *Model Climate Law Project Discussion Paper*. By Environmental Defender's Office NSW. Australian Network of Environmental Defenders Offices, 2008. Web. 9 Jan. 2012. <http://www.edo.org.au/edonsw/site/pdf/pubs/model_climate_law_project080417.pdf>.

Barbados. Coastal Zone Management Unit. *Integrated Coastal Zone Management Policy*. By Coastal Zone Management Unit of Barbados. Coastal Zone Management Unit of Barbados. Web. 23 Dec. 2011. <http://www.coastal.gov.bb/category.cfm?category=17>.

Barbados. *New Coastal Zone Management Act 1998*. American Society of International Law's Wildlife Interest Group. Web. 23 Dec. 2011. <http://www.internationalwildlifelaw.org/BarbadosCoastal.html>.

Brown, B. E., and Suharsono. "Damage and Recovery of Coral Reefs Affected by El Niño Related Seawater Warming in the Thousand Islands, Indonesia." *Coral Reefs* 8.4 (1990): 163-70. Print.

Brown, Nicole A., and Noel G. Bennett. *Consolidating Change: Lessons from a Decade of Experience in Mainstreaming Local Forest Management in Jamaica*. CANARI Technical Report Nº 390. Caribbean Natural Resources Institute, June 2010. Web. 8 Feb. 2012. <http://www.canari.org/documents/FINALLFMCCaseStudyJan2011.pdf>.

Caribbean Community Climate Change Centre. "Climate Change and the Caribbean: A Regional Framework for Achieving Development Resilient to Climate Change." Cpdcngo.org. Caribbean Policy Development Centre, July 2009. Web. 29 Jan. 2012. <http://www.cpdcngo.org/cpdc/attachments/article/107/Regional%20Framework.pdf>.

CARICOM. "A Strategy to Build the Resilience of the Caribbean Community to a Changing Climate (Draft)." 2009.

Chadee, D. D., S. Huntley, D. A. Focks, and A. A. Chen. "Aedes Aegypti in Jamaica, West Indies: Container Productivity Profiles to Inform Control Strategies." *Tropical Medicine and International Health* 14 (2009): 120-27. Print.

Chen, A. A., Wilma Bailey, and M. A. Taylor. *Enabling Activities for the Preparation of Jamaica's Second National Communication to the UNFCCC: Vulnerability and Adaptation in Human Health*. Rep. 2008. Print.

Cliquet, An, Chris Backes, Jim Harris, and Peter Howsam. "Adaptation to Climate Change Legal Challenges for Protected Areas." *Utrecht Law Review* 5 (2009): 158-75. Web. 9 Jan. 2012. <http://www.utrechtlawreview.org/index.php/ulr/article/viewFile/100/100>.

Columbia Law School. "Threatened Island Nations: Legal Implications of Rising Seas and a Changing Climate." Law.columbia.edu. Columbia Law School, 2011. Web. 9 Jan. 2012. <http://www.law.columbia.edu/centers/climatechange/resources/threatened-island-nations>.

Curriero, Frank C., Jonathan A. Patz, Joan B. Rose, and Subhash Lele. "The Association Between Extreme Precipitation and Waterborne Disease Outbreaks in the United States, 1948%u20131994." *American Journal of Public Health* 91.8 (2001): 1194-199. Ajph.aphapublications.org. American Journal of Public Health. Web. 25 Jan. 2012. <http://ajph.aphapublications.org/doi/full/10.2105/AJPH.91.8.1194>.

Desai, Bharat H. "Strengthening Legal and Policy Frameworks for Addressing Climate Change in Asia: India." Unep.org. United Nations Environment Programme. Web. 9 Jan. 2012. <http://www.unep.org/DEC/PDF/Casestudies/CCIndiadraft.pdf>.

Dwyer, Kamile. "Public Policy and Climate Change: Land-use Adaptation Strategies in Jamaica." Uwimona.edu.jm. Proc. of Climate Change: Impacts on the Caribbean, University of the West Indies, Mona Campus, Kingston. University of the West Indies, Mona Campus, 2007. Web. 11 Jan. 2012. <http://www.google.com.jm/url?sa=t&rct=j&q=climate%20change%3A%20impacts%20on%20the%20caribbean%20june%2015-17&source=web&cd=4&ved=0CEQQFjAD&url=http%3A%2F%2Fwww.mona.uwi.edu%2Feconomics%2Fnotices%2FClimate%2520Change%2520Conference%2FDay%25202%2FPanel%25206%2F4%2520Kamile%2520Dwyer%2520Public%2520Policy%2520and%2520Climate%2520Change%2520presentation.ppt&ei=-QEOT76hLIXMtge96eWmBQ&usg=AFQjCNHmRSHEK5Trt0QXO9o-KJLPjp5gNg>.

Easterling, W., P. Aggarwal, P. Batima, K. M. Brander, L. Erda, S. M. Howden, A. Kirilenko, J. Morton, J.-F. Soussana, J. Schmidhuber, and F. N. Tubiello. "IPCC Fourth Assessment Report: Climate Change 2007. Chapter 5: Food, Fibre, and Forest Products - 5.6.5 Food Security and Vulnerability." IPCC.ch. Intergovernmental Panel on Climate Change, 2007. Web. 29 Jan. 2012. <http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch5s5-6-5.html>.

ECLAC, and IDB. "Information on Disaster Risk Management Case Study of Five Countries Jamaica." Eclac.cl. Economic Commission for Latin America and the Caribbean, 2007. Web. 24 Jan. 2012. <http://www.eclac.cl/mexico/publicaciones/xml/1/33651/Jamaica_completo_sin_forros.pdf>.

ECLAC Subregional Headquarters for the Caribbean. "An Assessment of the Economic Impact of Climate Change on the Coastal and Human Settlements Sector in Barbados." Eclac.org. UN Economic Commission for Latin America and the Caribbean, 22 Oct. 2011. Web. 13 Jan. 2012. <http://www.eclac.org/portofspain/noticias/paginas/0/44160/lcarl326_Barbados_Coastal.pdf>.

Ehmer, Philipp, and Eric Heymann. "Climate Change and Tourism: Where Will the Journey Lead?" *Dbresearch.com*. Ed. Tobias Just. Deutsche Bank Research, 11 Apr. 2008. Web. 12 Jan. 2012. <http://www.dbresearch.com/PROD/DBR_INTERNET_EN-PROD/PROD0000000000222943.pdf>.

Epstein, P. *Climate and Health* 285.5426 (1999): 347-48. Chge.med.harvard.edu. Harvard Medical School Center for Health and the Global Environment. Web. 29 Jan. 2012. <http://chge.med.harvard.edu/about/faculty/journals/climate.pdf>.

Epstein, P. R., B. H. Sherman, E. S. Siegfried, A. Langston, S. Prasad, and B. Mckay. "Marine Ecosystems: Emerging Diseases as Indicators of Change." Heemd.org. Multiple Marine Ecological Disturbances, 1998. Web. 26 Jan. 2012. <http://heedmd.org/heed1998/HEED1998.HTM>.

ESL Management Solutions Limited. *Development of a National Water Sector Adaptation Strategy to Address Climate Change in Jamaica*. Belmopan, 2009. Dms.caribbeanclimate.bz. Caribbean Community Climate Change Centre. Web.

23 Jan. 2012. <http://www.google.com.jm/url?sa=t&rct=j&q=Jamaica+PRECIS+and+SDSM+for+7+regions&source=web&cd=1&ved=0CB4QFjAA&url=http%3A%2F%2F200.32.211.67%2FM-Files%2Fopenfile.aspx%3Fobjtype%3D0%26docid%3D2740&ei=MuQdT52ME8ectwe9qsyNCw&usg=AFQjCNHX9BwgG6sNypkTJLpmw0l4oEo0DA>.

FAO. "Increasing the Contribution of Small-scale Fisheries to Poverty Alleviation and Food Security." Fao.org. Food and Agriculture Organisation, 2005. Web. 26 Jan. 2012. <http://www.fao.org/docrep/009/a0237e/a0237e00.htm>.

Few, Roger, Henry Osbahr, Laurens M. Bouwer, David Viner, and Frank Sperling. "Linking Climate Change Adaptation and Disaster Risk Management for Sustainable Poverty Reduction Synthesis Report." Unisdr.org. United Nations International Strategy for Disaster Reduction, Nov. 2006. Web. 09 Jan. 2012. <http://www.unisdr.org/files/570_10367.pdf>.

Focks, D. A., E. Daniels, D. G. Haile, and J. E. Keesling. "A Simulation Model of the Epidemiology of Urban Dengue Fever: Literature Analysis, Model Development, Preliminary Validation, and Samples of Simulation Results." *The American Journal of Tropical Medicine and Hygiene* 53.5 (1995): 489-506. Mendeley.com. Mendeley. Web. 24 Jan. 2012. <http://www.mendeley.com/research/simulation-model-epidemiology-urban-dengue-fever-literature-analysis-model-development-preliminary-validation-samples-simulation-results/>.

Fransen, Taryn, Smita Nakhooda, Eric Chu, and Heather McGray. "National Climate Change Strategies: Comparative Analysis of Developing Country Plans." Wri.org. World Resources Institute, June 2009. Web. 09 Jan. 2012. <http://pdf.wri.org/working_papers/developing_country_actions_table.pdf>.

Frumkin, Howard, and Anthony J. McMichael. "Climate Change and Public Health: Thinking, Communicating, Acting." *American Journal of Preventive Medicine* 35.5 (2008): 403-10. PAHO.org. Pan-American Health Organization, 2008. Web. 20 Feb. 2012. <http://www.bvsde.paho.org/bvsacd/cd68/HFrumkin.pdf>.

Griebenow, Gonzalo. "Mainstreaming Climate Change in the Implementation of Poverty Reduction Strategies." *IOP Conf. Series: Earth and Environmental Science* 6 (2009): 1-2. Http://iopscience.iop.org. IOP Science, 2009. Web. 9 Jan. 2012. <http://iopscience.iop.org/1755-1315/6/41/412006/pdf/1755-1315_6_41_412006.pdf>.

Gyan, K., W. Henry, S. Lacaille, A. Laloo, C. Lamsee-Ebanks, S. McKay, R. M. Antoine, and M. A. Monteil. "African Dust Clouds Are Associated with Increased Paediatric Asthma Accident and Emergency Admissions on the Caribbean Island of Trinidad." *International Journal of Biometeorology* 49.6 (2005): 371-76. Pubmed.gov. National Center for Biotechnology Information, 2005. Web. 29 Jan. 2012. <http://www.ncbi.nlm.nih.gov/pubmed/15692817>.

Hales, Simon, Neil De Wet, John Maindonald, and Alistair Woodward. "Potential Effect of Population and Climate Changes on Global Distribution of Dengue

Fever: An Empirical Model." *The Lancet* 360 (2002): 830-34. Cmdr.ubc.ca. The Centre for Microbial Diseases and Immunity Research, University of British Columbia. Web. 24 Jan. 2012. <http://www.cmdr.ubc.ca/trainingprogram/papers/journalpaper_June18b_04.pdf>.

Hamilton, Jacqueline M., and Richard S.J. Tol. "The Impact Of Climate Change On Tourism And Recreation." *Ideas.repec.org*. Economic Research Federal Reserve Bank of St. Louis, 2004. Web. 12 Jan. 2012. <http://www.fnu.zmaw.de/fileadmin/fnu-files/publication/working-papers/tourlitrev.pdf>.

Hermes, Rudolf, David Brown, and Florence Poulain. "Fisheries and Aquaculture Climate Change: Vulnerability and Adaptation." Fao.org. Food and Agriculture Organisation, Feb. 2008. Web. 9 Jan. 2012. <http://www.fao.org/fileadmin/user_upload/foodclimate/presentations/disaster/hermesb.pdf>.

Huq, Saleemul, Atiq Rahman, Mama Konate, Youba Sokona, and Hannah Reid. "Mainstreaming Adaptation to Climate Change in Least Developed Countries (LDCS)." Un.org. United Nations, 2003. Web. 2012. <http://www.un.org/special-rep/ohrlls/ldc/LDCsreport.pdf>.

IDLO. "IDLO Warns Climate Change Mechanisms Will Fail Without Strengthened Legal Capacity in Developing Countries." Idlo.int. International Development Law

Organization, 15 Dec. 2009. Web. 09 Jan. 2012. <http://www.idlo.int/DocNews/407doc.pdf>.

Interdepartmental Working Group on Climate Change. "Adaptation to Climate Change in Agriculture, Forestry and Fisheries: Perspective, Framework and Priorities." Fao.org. Food and Agriculture Organisation, 2007. Web. 12 Jan. 2012. <ftp://ftp.fao.org/docrep/fao/009/j9271e/j9271e.pdf>.

IPCC. "IPCC Fourth Assessment Report: Climate Change 2007 (AR4)." IPCC.ch. Intergovernmental Panel on Climate Change. Web. 30 Jan. 2012. <http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml>.

Jackson, Ivor. "Potential Impact of Climate Change on Tourism (Draft)." Oas.org. Organisation of American States. Web. 12 Jan. 2012. <http://www.google.com.jm/url?sa=t&rct=j&q=impact%20climate%20change%20tourism&source=web&cd=2&sqi=2&ved=0CFAQFjAB&url=http%3A%2F%2Fwww.oas.org%2Fmacc%2Fdocs%2Ftourismissues.doc&ei=SpgPT4PvLo-5tweovrSGAg&usg=AFQjCNFKermRSmD-z9TSTk_fWixx_o43AQ>.

Jamaica. Forestry Department. *Strategic Forest Management Plan 2010 - 2015*. By Forestry Department. Forestry.gov.jm. Forestry Department, 2010. Web. 24 Jan. 2012. <http://www.forestry.gov.jm/PDF_files/SFMP_Final.pdf>.

Jamaica. Manchester Parish Council. Manchester Parish Development Committee. *Parish of Manchester Local Sustainable Development Plan 2030 and Beyond*. Ed. Phil Rodriques. Manchesterpdc.org. Manchester Parish Development

Committee. Web. 4 Jan. 2012. <http://manchesterpdc.org/manchester-local-sustainable-development-plan/>.

Jamaica. Ministry of Agriculture and Fisheries. *Agricultural Land Use Policy*. By Ministry of Agriculture and Fisheries. Print.

---.*Draft Fisheries Policy*. By Fisheries Division. Ministry of Agriculture and Fisheries. Web. 18 Jan. 2011. <http://www.moa.gov.jm/Fisheries/legislation_Draft_Fisheries_Policy_Framework.php>

---. Forestry Department. *National Forest Management and Conservation Plan*. By Forestry Department. 2000. Forestry.gov.jm. Forestry Department. Web. 24 Jan. 2012. <http://www.forestry.gov.jm/PDF_files/ForestPlan.pdf>.

---. *National Plant Health Policy*. 2011. Print.

Jamaica. Ministry of Energy and Mining. *Draft Carbon Emissions Trading Policy*. By Ministry of Energy and Mining. 2009. Men.gov.jm. Ministry of Energy and Mining, Aug. 2009. Web. 29 Jan. 2012. <http://www.men.gov.jm/PDF_Files/Draft%20Carbon%20EmissionsTrading%20Policy.pdf>.

---. *Green Paper: The Jamaica Energy Policy 2006 - 2020*. By Ministry of Energy and Mining. 2006. *Men.gov.jm*. Ministry of Energy and Mining. Web. 29 Jan. 2012. <http://www.men.gov.jm/PDF%20Files/Energy%20Policy/Energy_Policy_Green_Paper.pdf>.

---. *National Renewable Energy Policy 2009 – 2030 …Creating a Sustainable Future*. By Ministry of Energy and Mining. 2010.Men.gov.jm. Ministry of Energy and Mining, 26 Aug. 2010. Web. 29 Jan. 2012. <http://www.men.gov.jm/PDF_Files/Energy_Policy/National_Renewable_Energy_Policy_August_26_2010.pdf>.

Jamaica. Ministry of Health. *National Health Policy 2006 - 2015 and Strategic Plan 2006 - 2010*. By Margaret E. Lewis. Healthresearchweb.org, 2005. Web. 23 Dec. 2011. <http://www.healthresearchweb.org/files/National_Health_Policies-Jamaica_2006-2015.pdf>.

Jamaica. Ministry of Land and the Environment. *Policy on Strategic Environmental Assessment*. By Environmental Action Programme. 2003. Nrca.org. National Environment and Planning Agency. Web. 12 Feb. 2012. <http://www.nrca.org/policies/SEA/FinalDraft_SEAPolicy_July2003.pdf>.

Jamaica. Ministry of Water. *Jamaica Water Sector Policy Paper.* 1999. Nwcjamaica.com. National Water Commission. Web. 12 Jan. 2012. <http://www.nwcjamaica.com/PDFs/Misc/20070528%20-%20Jamaica%20Water%20Sector%20Policy%20Paper.pdf>.

Jamaica. National Environment and Planning Agency. *Beach Policy 2000*. National Environment and Planning Agency. Web. 18 Dec. 2011. <http://www.nepa.gov.jm/policies/beach/BeachPolicy2000.pdf>.

---. *Draft Policy and Regulation for Mangrove and Coastal Wetlands Protection.* National Environment and Planning Agency. Web. 18 Dec. 2011. <http://www.nepa.gov.jm/policies/Draft-Policy-mangrove-costal-protection.pdf>.

---. *Draft Watershed Policy*. National Environment and Planning Agency. Web. 18 Dec. 2011. <http://www.nepa.gov.jm/policies/DRAFT%20WATERSHED%20POLICY.pdf>.

---. *Environmental Management Systems Green Paper*. By Environmental Management Systems (EMS) Policy & Strategy Working Group. National Environment and Planning Agency. Web. 18 Dec. 2011. <http://www.nepa.gov.jm/policies/ems/EMS_green_paper.htm>.

---. *Jamaica Coral Reef Action Plan*. 1999. *Nepa.gov.jm*. National Environment and Planning Agency. Web. 28 Feb. 2012. <http://www.nepa.gov.jm/symposia_03/Policies/JCRAP.pdf>.

---. *NEPA Climate Change Response Strategy, 2010-2015*. By National Environment and Planning Agency. Print.

Jamaica. National Irrigation Commission. *National Irrigation Development Master Plan*. Print.

Jamaica. *National Land Policy of Jamaica*. By Government of Jamaica. Government of Jamaica, Jan. 1997. Web. 19 Dec. 2011. <http://www.spatialvision.com/Nat_Land_POLICY.pdf>.

Jamaica. National Meteorological Service. *Final Report Jamaica's Greenhouse Gas Mitigation Assessment*. By Claude Davis and Associates. National Meteorological Service, 2010. Web. 2011. <http://www.metservice.gov.jm/Climate%20Change/Final%20Report-Jamaica%27s%20Greenhouse%20GAs%20Mitigation.pdf>.

---. *Jamaica's National Climate Change Policy and Adaptation Plan (Draft*). By Jamaica Meteorological Services. 2009. Print.

---. *The Second National Communication of Jamaica to the United Nations Framework Convention on Climate Change*. By National Meteorological Service. 2011. Unfccc.int. United Nations Framework Convention on Climate Change. Web. 25 Jan. 2012. <http://unfccc.int/resource/docs/natc/snc2_jamaica.pdf>.

Jamaica. Planning Institute of Jamaica. *Vision 2030 Jamaica National Development Plan*. By Planning Institute of Jamaica. 2009. Vision2030.gov.jm. Vision 2030 Jamaica, 2009. Web. 18 Dec. 2011. <http://www.vision2030.gov.jm/Portals/0/NDP/Vision%202030%20Jamaica%20NDP%20Full%20No%20Cover%20(web).pdf>.

---. *Final Draft Agriculture Sector Plan*. By Planning Institute of Jamaica. 2009. Vision2030.gov.jm. Vision 2030 Jamaica, Sept. 2009b. Web. 20 Feb. 2012. <http://www.vision2030.gov.jm/Portals/0/Sector_Plan/Microsoft%20Word%20-%20Vision%202030%20Jamaica%20-%20Final%20Draft%20Agriculture%20Sector%20Plan%20%E2%80%A6.pdf>.

---. *Vision 2030 Jamaica National Development Plan: Poverty Reduction Strategic Plan Final Draft*. By Planning Institute of Jamaica. 2009. Vision2030.gov.jm. Vision 2030 Jamaica, 2009c. Web. 12 Feb. 2012. <http://www.vision2030.gov.jm/Portals/0/Sector_Plan/Microsoft Word - POVERTY REDUCTION SECTOR PLAN pdf.pdf>.

Jamaica. *The Urban Development Corporation Act*. By Government of Jamaica. 1968. Http://www.moj.gov.jm. Ministry of Justice. Web. 12 Feb. 2012. <http://www.moj.gov.jm/sites/default/files/laws/Urban%20Development%20Corporation%20Act.pdf>.

Jamaica. Water Resources Authority. *Water Resources Development Master Plan for Jamaica*. Print.

"Jamaica's Initial Climate Change Technology Needs Assessment." Unfccc.int. United Nations Framework Convention on Climate Change. Web. 23 Dec. 2011. <Jamaica's Initial Climate Change Technology Needs Assessment>.

Karanjac, Jasminko. "Vulnerability of Ground Water in the Karst of Jamaica." Karanjac.com. Jasminko Karanjac, 2005. Web. 24 Jan. 2012. <http://karanjac.com/papers/jamaica.doc>.

Keohane, Robert O., and David G. Victor. "The Regime Complex for Climate Change." Discussion Paper 2010.33 (2010). Http://belfercenter.ksg.harvard.edu. Harvard Project on International Climate Agreements, Belfer Center for Science and International Affairs, Harvard Kennedy School, Jan. 2010. Web. 9 Jan. 2012.

<http://belfercenter.ksg.harvard.edu/publication/19880/regime_complex_for_climate_change.html>.

King, Peter N. "Mainstreaming Climate Change – a Guidance Manual for the Pacific Islands Countries and Territories." Sprep.org. Secretariat of the Pacific Regional Environment Programme, May 2010. Web. 12 Feb. 2012. <http://www.sprep.org/att/publication/000848_Mainstreaming_Climate_Change_PACC_Project.pdf>.

Kramer, Arnoldo M. "Adaptation to Climate Change in Poverty Reduction Strategies." Hdr.undp.org. Human Development Report United Nations Development Programme, 2007. Web. 09 Jan. 2012. <http://hdr.undp.org/en/reports/global/hdr2007-8/papers/Matus%20Kramer_Arnoldo.pdf>.

Lessios, H. A., D. R. Robertson, and J. D. Cubit. "Spread of Diadema Mass Mortality Through the Caribbean." Science 226.4672 (1984): 335-37. Stri.si.edu. Smithsonian Tropical Research Institute. Web. 26 Jan. 2012. <http://www.stri.si.edu/sites/publications/PDFs/Lessios_Ross%20Science%201984.pdf>.

Lewsey, Clement, Gonzalo Cid, Edward Kruse, and John Virdin. *Mainstreaming Adaptation to Climate Change (MACC) Climate Change Impacts on Land Use Planning and Coastal Infrastructure*. Rep. Organisation of American States. Web. 12 Jan. 2012. <http://www.google.com.jm/url?sa=t&rct=j&q=mainstreaming climate change

housing settlements&source=web&cd=1&ved=0CCAQFjAA&url=http://www.oas.org/macc/Docs/LUPInfrastIssues.doc&ei=BYEPT4rsO5Dbtwe-67yFAg&usg=AFQjCNHAzrvZXiMDKMkrCKmZppURWhXsEA>.

Lyew-Ayee Jr, Parris, Christina Francis, and Rafi Ahmad. "Introducing: The Natural Hazards Atlas for Jamaica." Monagis.com. Mona GeoInformatics Institute, July 2009. Web. 23 Dec. 2011. <http://www.monagis.com/files/Presentations/ATLAS.pdf>.

"Mainstreaming Adaptation to Climate Change." Oas.org. Organisation of American States, Apr. 2002. Web. 9 Jan. 2012. <http://www.oas.org/macc/Docs/MACC-BRO.pdf>.

McCarthy, M. "Dust Clouds Implicated in Spread of Infection." The Lancet 358.9280 (2001): 478. Print.

Nelson, Winifred, and Sarah Naa Dedei Agbey. "Linkages Between Poverty and Climate Change: Adaptation for Livelihood of the Poor in Ghana." Nlcap.net. The Netherlands Climate Assistance Programme, Apr. 2005. Web. 9 Jan. 2012. <http://www.nlcap.net/fileadmin/NCAP/Countries/Ghana/032135.0403xx.GHA.CON-01.Output8.v1.pdf>.

Neufville, Zadie. "Jamaica's Dream of Universal Access to Water Evaporates." *Environment News Service*. 27 Mar. 2002. Web. 29 Jan. 2012. <http://www.ens-newswire.com/ens/mar2002/2002-03-27-03.html>.

New Zealand. Department of Conservation. *New Zealand Coastal Policy Statement 2010*. Wellington: Department of Conservation, 2010. New Zealand Coastal Policy Statement 2010. Department of Conservation. Web. 13 Jan. 2012. <http://doc.org.nz/publications/conservation/marine-and-coastal/new-zealand-coastal-policy-statement/new-zealand-coastal-policy-statement-2010/>.

New Zealand. Ministry for the Environment. *Adapting to Sea Level Rise*. Ministry for the Environment, 8 Sept. 2011. Web. 13 Jan. 2012. <http://www.mfe.govt.nz/issues/climate/adaptation/sea-level-rise.html>.

---. Ministry for the Environment. National Institute of Water and Atmospheric Research Ltd. Planning for Climate Change Effects on Coastal Margins. By R. G. Bell, T. M. Hume, and D. M. Hicks. Wellington: Ministry for the Environment, 2001. Mfe.govt.nz. Ministry for the Environment. Web. 13 Jan. 2012. <http://www.mfe.govt.nz/publications/climate/effect-coastal-sep01/effect-coastal-sep01.pdf>.

---. Ministry of Agriculture and Forestry. *A Guide to Forestry in the Emissions Trading Scheme*. Ministry of Agriculture and Forestry, 13 May 2011. Web. 13 Jan. 2012. <http://www.maf.govt.nz/news-resources/publications.aspx?title=Guide%20to%20Forestry%20in%20the%20Emissions%20Trading%20Scheme>.

Nkem, Johnson, Heru Santoso, Daniel Murdiyarso, Maria Brockhaus, and Markku Kanninen. "Using Tropical Forest Ecosystem Goods and Services for Planning

Climate Change Adaptation with Implications for Food Security and Poverty Reduction." *Journal of SAT Agricultural Research* 4.1 (2007): 1-23. Ejournal.icrisat.org. International Crop Research Institute for the Semi-Arid Tropics, Dec. 2007. Web. 9 Jan. 2012. <http://ejournal.icrisat.org/SpecialProject/sp17.pdf>.

Nurse, Leonard. "Incorporating Climate Change Projections into Caribbean Fisheries Management." Gulf and Caribbean Fisheries Institute. Gosier, Guadeloupe, French West Indies. 2009. 130-38. Gcfi.org. Gulf and Caribbean Fisheries Institute, 2009. Web. 9 Jan. 2012. <http://procs.gcfi.org/pdf/GCFI_61-20.pdf>.

OAS. "CDMP: Storm Hazard Atlas: Jamaica." OAS.org. Organisation of American States, 2000. Web. 24 Jan. 2012. <http://www.google.com.jm/url?sa=t&rct=j&q=CDMP%2FOAS%2C+2000+Port+esquivel+jamaica&source=web&cd=1&ved=0CCoQFjAA&url=http%3A%2F%2Fwww.oas.org%2Fcdmp%2Fdocument%2Freglstrm%2Fjamaica.ppt&ei=bDEfT6CRH4mltwem6MhL&usg=AFQjCNGY3eL_EPl5llePNqHbCLWQBd8a_A>.

PAHO. "Climate Change and Human Health - Risks and Responses. Revised Summary."WHO.int. World Health Organisation, 2008. Web. 20 Feb. 2012. <http://www.paho.org/english/dd/pin/climatechangeEN.pdf>.

---. "Strategy and Plan of Action on Climate Change." PAHO.org. Pan-American Health Organization, Sept. 2011. Web. 20 Feb. 2012. <http://new.paho.org/hq/index.php?option=com_docman&task=doc_download&gid=14471&Itemid=>.

Patz, Jonathan A., and Cindy L. Parker. "Climate and Health in Small Island States." Who.int. World Health Organisation. Web. 26 Jan. 2012. <https://apps.who.int/environmental_information/Climate/Samoa/Samoabackgr.htm>.

Peeters, Paul. "The Impact of Tourism on Climate Change." Thepep.org. United Nations Economic Commission for Europe - Transport, Health and Environment Pan-European Programme. Web. 12 Jan. 2012. <http://www.thepep.org/ClearingHouse/docfiles/Impact.of.Tourism.pdf>.

"Poverty and Climate Change Reducing the Vulnerability of the Poor through Adaptation." Oecd.org. Ed. Frank Sperling. Organisation for Economic Co-operation and Development. Web. 9 Jan. 2012. <http://www.oecd.org/dataoecd/60/27/2502872.pdf>.

Powell, Leiska. "The Impact of Climate Change on Coastal Areas in Jamaica: The Importance of Coastal Zone Management." Mona.uwi.edu. Proc. of Climate Change: Impacts on the Caribbean, University of the West Indies, Mona Campus, Kingston. University of the West Indies, Mona Campus, 2007. Web. 23 Dec. 2011. <http://www.google.com.jm/url?sa=t&rct=j&q=climate%20change%20jamaica&source=web&cd=5&ved=0CGcQFjAE&url=http%3A%2F%2Fwww.mona.uwi.edu%2Feconomics%2Fnotices%2FClimate%2520Change%2520Conference%2FDay%25202%2FPanel%25206%2F2%2520Leiska%2520Powell%2520Climate%25

20change%2520presentation.ppt&ei=Ncj0Tpwiwoi3B-3FiNAG&usg=AFQjCNF22v8fo2T-ygo4MoY0MsNZU7wo5A>.

Quan, Julian, and Nat Dyer. "Climate Change and Land Tenure the Implications of Climate Change for Land Tenure and Land Policy." Fao.org. Food and Agriculture Organisation, 2008. Web. 12 Jan. 2012. <ftp://ftp.fao.org/docrep/fao/011/aj332e/aj332e00.pdf>.

Racelis, Diomedes A. "Mainstreaming Climate Change Adaptation in the Philippine Forestry and Natural Resources Sector." SciVee.tv. SciVee, 7 May 2010. Web. 12 Jan. 2012. <http://www.scivee.tv/node/17880>.

Raj Regmi, Bimal, and Ramu Subedi. "Mainstreaming Climate Change Adaptation Through Community Based Planning." Forestrynepal.org. Forestry Nepal, 2010. Web. 12 Jan. 2012. <http://www.forestrynepal.org/publications/reports/4794>.

Republic of the Philippines. *REPUBLIC ACT NO. 9729 Climate Change Act of 2009*. By Republic of the Philippines. Legal Rights and Natural Resources Center. Web. 12 Feb. 2012. <http://www.lrcksk.org/research-and-policy-development/laws-and-policy/92-climate-change-act-of-2009>.

Revi, Aromar. "Climate Change Risk: An Adaptation and Mitigation Agenda for Indian Cities." Environment and Urbanization 20.1 (2008): 207-29. Sagepub.com. Sage, 2 Apr. 2008. Web. 12 Jan. 2012. <http://eau.sagepub.com/content/20/1/207.abstract>.

Salas, Silvia, Ratana Chuenpagdee, Juan C. Seijo, and Anthony Charles. "Challenges in the Assessment and Management of Small-scale Fisheries in Latin America and the Caribbean." *Fisheries Research* 87 (2007): 5-16. Husky1.stmarys.ca. St. Mary's University. Web. 26 Jan. 2012. <http://husky1.stmarys.ca/~charles/PDFS_2005/007.pdf>.

Sanchez-Rodriguez, Roberto, Michail Fragkias, and William Solecki. *Urban Responses to Climate Change a Focus on the Americas A Workshop Report*. Rep. 2008. Iccip.net. International Climate Change Information Programme. Web. 13 Jan. 2012. <http://ccsl.iccip.net/ur2cc.pdf>.

Satterthwaite, David, Saleemul Huq, Hannah Reid, Mark Pelling, and Patricia Romero Lankao. "Adapting to Climate Change in Urban Areas: The Possibilities and Constraints in Low- and Middle-Income Nations." Iied.org. International Institute for Environment and Development, Oct. 2007. Web. 12 Jan. 2012. <http://pubs.iied.org/pdfs/10549IIED.pdf?>.

Strang, Charles. "Climate Change in Barbados." Rtpi.org.uk. Royal Town Planning Institute, 2009. Web. 11 Jan. 2012. <http://www.rtpi.org.uk/item/3100>.

Tear Fund. "Overcoming the Barriers Mainstreaming Climate Change Adaptation in Developing Countries." Tearfund.org. Tear Fund, 2006. Web. 9 Jan. 2012. <http://www.tearfund.org/webdocs/website/Campaigning/Policy%20and%20research/Overcoming%20the%20barriers%20briefing%20paper.pdf>.

Thomas, Damani. "Tourism Industry at Risk: The Economic Impact of Climate Change." Uwimona.edu.jm. Proc. of Climate Change: Impacts on the

Caribbean, University of the West Indies, Mona Campus, Kingston. University of the West Indies, Mona Campus, 2007. Web. 12 Jan. 2012. <http://www.mona.uwi.edu/economics/notices/Climate Change Conference/Day 2/Panel 6/3 Damani Thomas Tourism Industry at Risk.ppt>.

Thomas-Hope, Elizabeth. "Climate Change and Agriculture." Nepa.gov.jm. National Environment and Planning Agency. Web. 11 Jan. 2012. <http://www.nepa.gov.jm/neec/front_page/CCF/presentations/Prof.%20Elizabeth%20Thomas-Hope%20-%20Climate%20Change%20and%20Agriculture.pdf>.

Thoreau, Thomas J. "Coral Bleaching in Jamaica." Globalcoral.org. Global Coral Reef Alliance. Web. 26 Jan. 2012. <http://www.globalcoral.org/Coral%20Bleaching%20in%20Jamaica.htm>.

Tompkins, Emma L., Sophie A. Nicholson-Cole, Lisa-Ann Hurlston, Emily Boyd, Gina Brooks Hodge, Judi Clarke, Gerard Gray, Neville Trotz, and Lynda Varlack. *Surviving Climate Change in Small Islands - A Guidebook*. Norwich: Tyndall Centre for Climate Change, School of Environmental Sciences, University of East Anglia Research, 2005. Preventionweb.net. Prevention Web. Web. 13 Jan. 2012. <http://www.preventionweb.net/files/9778_surviving.pdf>.

UNDP. "2011 Human Development Report Launched." Jm.undp.org. United Nations Development Programme Jamaica, 2011. Web. 25 Jan. 2012. <http://www.jm.undp.org/node/560>.

---. "Human Development Report 2007/2008 Fighting Climate Change: Human Solidarity in a Divided World." UNDP.org. UNDP, 2007. Web. 23 Jan. 2012. <http://hdr.undp.org/en/media/HDR_20072008_EN_Complete.pdf>.

UNDP-UNEP. "Mainstreaming Climate Change Adaptation into Development Planning: A Guide for Practitioners." Unep.org. United Nations Environment Programme, 2011. Web. 9 Jan. 2012. <http://www.unep.org/pdf/mainstreaming-cc-adaptation-web.pdf>.

UNEP (United Nation Environment Programme). *Climate Change in the Caribbean and the Challenge of Adaptation*. By UNEP Regional Office for Latin America and the Caribbean. Panama City: UNEP, 2008. Pnuma.org. United Nations Environment Programme Regional Office for Latin America and the Caribbean. Web. 11 Jan. 2012. <http://www.pnuma.org/raiz/Climate_Change_in_the_Caribbean_Final_LOW20oct.pdf>.

UNEP - Caribbean Environment Programme, and Centre of Engineering and Environmental Management of Bays and Coasts. *Baseline Analysis on Domestic Wastewater Management in the Wider Caribbean Region*. Havana, 2010. *Cep.unep.org*. The Caribbean Environment Programme, 2010. Web. 26 Apr. 2012. <http://www.cep.unep.org/meetings-events/lbs-regional-experts-workshop/baseline-domestic-wastewater.pdf>.

UNFCCC. "Climate Change: Impacts, Vulnerabilities and Adaptation in Developing Countries." Iccip.net. International Climate Change Information Programme. Web. 13 Jan. 2012. <http://ccsl.iccip.net/pub_07_impacts.pdf>.

UN-Habitat. *Global Report on Human Settlements 2009: Planning Sustainable Cities*. Malta: Earthscan, 2009. Unhabitat.org. UN-Habitat. Web. 13 Jan. 2012. <http://www.unhabitat.org/pmss/getElectronicVersion.aspx?nr=2831&alt=1>.

United Nations World Water Assessment Programme. "Climate Change and Water An Overview from the World Water Development Report 3: Water in a Changing World." Iccip.net. International Climate Change Information Programme, 2009. Web. 13 Jan. 2012. <http://ccsl.iccip.net/climate_change_and_water.pdf>.

University at Buffalo. "Global Warming: Sea Level Rise Could Be Twice As High As Current Projections, Greenland Ice Sheet Study Suggests." *ScienceDaily*. Science Daily, 11 Feb. 2008. Web. 23 Jan. 2012. <http://www.sciencedaily.com/releases/2008/02/080211172517.htm>.

Watson, R. T., M. C. Zinyowera, R. H. Moss, and D. J. Dokken, eds. *Climate Change 1995 Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses*. New York: Cambridge UP, 1996. Print. Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change

Webber, Dale. "Climate Change Impacts on Jamaica's Biodiversity." Nepa.gov.jm. Web. 23 Dec. 2011. <http://www.nepa.gov.jm/neec/front_page/CCF/presentations/Dr.%20Dale%

20Webber%20-%20Climate%20Change%20Impacts%20on%20Jamaica%27s%20Biodiversity.pdf>.

World Bank. "Climate Change Aspects in Agriculture: Mexico Country Note." Http://siteresources.worldbank.org. World Bank, 2009. Web. 9 Jan. 2012. <http://siteresources.worldbank.org/INTLAC/Resources/257803-1235077152356/Country_Note_Mexico.pdf>.

World Bank. "DAR ES SALAAM CASE STUDY OVERVIEW CLIMATE CHANGE, DISASTER RISK AND THE URBAN POOR: CITIES BUILDING RESILIENCE FOR A CHANGING WORLD." Worldbank.org. World Bank. Web. 12 Jan. 2012. <http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1306291319853/CS_Dar_Es_Salaam.pdf>.

World Fish Center. "Climate Change: Research to Meet the Challenges Facing Fisheries and Aquaculture." Worldfishcenter.org. Http://www.worldfishcenter.org/resource_centre/WF_2167.pdf, Nov. 2009. Web. 9 Jan. 2012. <http://www.worldfishcenter.org/resource_centre/WF_2167.pdf>.

World Health Organization. *Climate Change and Human Health - Risks and Responses Summary.* World Health Organization, 2003. Iccip.net. International Climate Change Information Programme, 2003. Web. 13 Jan. 2012. <http://ccsl.iccip.net/ccscreen.pdf>.

World Meteorological Organization, and UNEP. "Climate Change and Tourism Responding to Global Challenges." Unwto.org. World Tourism Organization, 9 July 2008. Web. 12 Jan. 2012. <http://sdt.unwto.org/sites/all/files/docpdf/climate2008.pdf>.

World Tourism Organization, UNEP, and World Meteorological Organization. "Climate Change and Tourism: Responding to Global Challenges. Advanced Summary." Un.org. United Nations, Oct. 2007. Web. 12 Jan. 2012. <http://esa.un.org/marrakechprocess/pdf/davos_rep_advan_summ_26_09.pdf>.

World Tourism Organization, UNEP, and World Meteorological Organization. "Climate Change and Tourism Responding to Global Challenges Summary." Onecaribbean.org. Caribbean Tourism Organization, June 2008. Web. 12 Jan. 2012. <http://www.onecaribbean.org/content/files/unwtoclimatechangereport.pdf>.