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**REVIEW OF THE ECONOMICS OF CLIMATE CHANGE (RECC)
IN THE CARIBBEAN PROJECT: Phase I**

CLIMATE CHANGE PROFILES IN SELECT CARIBBEAN COUNTRIES

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FOREWORD

These reports are the result of consultations which were conducted in 2008 in Aruba, Barbados, Netherlands Antilles, Dominican Republic, Guyana, Jamaica, Montserrat, Saint Lucia and Trinidad and Tobago. The objective was to obtain relevant information that would inform a Stern-type report where the economics of climate change would be examined for the Caribbean subregion. These reports will be complimented by future assessments of the costs of the “business as usual”, adaptation and mitigation responses to the potential impacts of climate change.

It is anticipated that the information contained in each country report would provide a detailed account of the environmental profile and would, therefore, provide an easy point of reference for policymakers in adapting existing policy or in formulating new ones. ECLAC continues to be available to the CDCC countries to provide technical support in the area of sustainable development.

Neil Pierre
Director

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LIST OF ACRONYMS

ACCC	Adapting to Climate Change in the Caribbean
ACS	Association of Caribbean States
A-OGCM	Atmosphere-Ocean General Circulation Model
AOSIS	Alliance of Small Island States
bPTT	British Petroleum of Trinidad and Tobago
CANARI	Caribbean Natural Resources Institute
CAP	Common Agricultural Policy
CARICOM	Caribbean Community
CBD	Convention on Biological Diversity
CBO	Community-Based Organization
CCCCC	Caribbean Community Climate Change Centre
CCS	Carbon Capture and Storage
CDB	Caribbean Development Bank
CDEMA	Caribbean Disaster and Emergency Management Agency
CDM	Clean Development Mechanism
CEHI	Caribbean Environmental Health Institute
CEPEP	Community-Based Environmental Protection and Enhancement Programme
CERS	Certified Emissions Reductions
CFCS	Chlorofluorocarbons
CFLS	Compact Fluorescents
CGCED	Caribbean Group for Cooperation in Economic Development
CIDA	Canadian International Development Agency
CIMH	Caribbean Institute for Meteorology and Hydrology
CITES	Convention on International Trade of Endangered Species
CNG	Compressed Natural Gas
CO ₂	Carbon Dioxide
COP3	Third Session of the Conference of Parties
CPACC	Caribbean Planning for Adaptation to Climate Change
CRIS	Coastal Resource Information System
CTO	Caribbean Tourism Organization
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
DFID	Department for International Development of the United Kingdom of Great Britain and Northern Ireland
DRM	Disaster Risk Management
ECACC	Enhancing Capacity for Adaptation to Climate Change in the Caribbean
ECLAC	Economic Commission for Latin America and the Caribbean
EIA	Environmental Impact Assessment
EMA	Environmental Management Authority
EMLUP	Environmental Management and Land Use Planning for Sustainable Development Project
EOR	Enhanced Oil Recovery
ESDU	Environment and Sustainable Development Unit of the OECS
FAO	Food and Agriculture Organization
GCC	Global Climate Change
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas

GIS	Geographic Information Systems
GOF	Global Opportunities Fund
GPS	Global Positioning System
GRULAC	Group of Latin America and Caribbean Countries
IAST	Institute of Applied Sciences and Technology
IDB	Inter-American Development Bank
IMF	International Monetary Fund
IMO	International Maritime Organization
INSMET	Institute of Meteorology (Cuba)
IPCC	Intergovernmental Panel on Climate Change
LDCs	Least Developed Countries
LIS	Land Information System
MACCC	Mainstreaming Adaptation to Climate Change
MARPOL	International Convention for the Prevention of Pollution from Ships
MEA	Multilateral Environmental Agreements
MSI	Mauritius Strategy
NCCA	National Climate Change Adaptation
NEMO	National Emergency and Management Office
NEPA	National Environment and Planning Agency
NEPP	Nature and Environmental Policy Plan
NICU	National Implementation Coordinating Unit
NISP	National Integral Strategic Plan
NOAA	National Oceanic and Atmospheric Association
OECS	Organisation of Eastern Caribbean States
PAHO	Pan American Health Organization
PDP	Physical Development Plan
PEO	Public Education And Outreach
PETROTRIN	Petroleum Company of Trinidad and Tobago
PIOJ	Planning Institute of Jamaica
PRECIS	Providing Regional Climates for Impacts Studies
RECC	Review of the Economics of Climate Change
REDD	Reduction of Emissions from Deforestation and Degradation
SBI	Subsidiary Body for Implementation
SBSTA	Subsidiary Body for Scientific and Technological Advice
SCCF	Special Climate Change Fund
SGP	Small Grants Programme
SIDS	Small Island Developing States
SLMS	St Lucia Meteorological Services
SMMA	Soufrière Marine Management Area
SPACC	Special Pilot Adaptation to Climate Change
SPAW	Specially Protected Areas and Wildlife
TRINMAR	Trinidad Marine
UNCCD	United Nations Convention to Combat Desertification
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCC	United Nations Framework Convention on Climate Change
UWI	University of the West Indies
WHO	World Health Organization
WMO	World Meteorological Organization

I. INTRODUCTION

A. GLOBAL AND REGIONAL CLIMATE CHANGE CONTEXT

The Earth's climate has been changing for millennia, marked by phases of cooling and warming under a cycle of natural variability. However, over the last century, records have shown an anomalous warming of global atmospheric temperatures which has been paralleled by the growth in anthropogenic greenhouse gas (GHG) emissions.¹

As a result of past emissions of carbon dioxide (CO₂) and other GHGs, the world is now on course for future climate change. This year's Human Development Report identifies 2°C as the threshold above which irreversible and dangerous impacts of climate change will become unavoidable. It also emphasises that we have less than a decade to change strategy and start living within a sustainable global carbon budget identified at 14.5 gigatonnes of CO₂ (Gt CO₂) per annum for the remainder of the twenty-first century. Currently, emissions are at twice this level. If these trends continue, the carbon budget will be set for expiry during the 2030s, putting in motion processes that can lead to temperature increases of 5°C or above by the end of this century – roughly similar to temperature changes since the last ice age 10,000 years ago.²

In 1988, in response to growing concerns about global environmental issues, particularly global warming and its effects, the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) established the Intergovernmental Panel on Climate Change (IPCC) which was mandated “to assess the state of existing knowledge about the climate system and climate change; the environmental, economic, and social impacts of climate change; and the possible response strategies”.

In 1992 the United Nations Framework Convention on Climate Change (UNFCCC) was adopted. Its ultimate objective is the:

“stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic [human-induced] interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure food production is not threatened and to enable economic development to proceed in a sustainable manner”.

The Convention³ called for Parties (individually or jointly) to reduce their GHG emissions to 1990 levels. The Convention divides Parties into two groups: Annex I Parties (mainly developed countries and those with “economies in transition”⁴), and Non-Annex I Parties (those countries not included in Annex I which are mainly developing countries).

¹ Intergovernmental Panel for Climate Change (IPCC) Third Assessment Report: Climate Change 2001.

² United Nations Development Programme (UNDP) Human Development Report 2007/2008: Fighting Climate Change.

³ The UNFCCC is also referred to as “The Convention”.

⁴ An “economy in transition” is one which is in the process of changing from a planned economy to a market economy.

As scientific understanding of the climate system improved, the commitments under the Convention were reviewed, and it was subsequently concluded that this reduction was not enough to fulfil the objective of the Convention. In 1997, the first global agreement, Kyoto Protocol, obligating Annex I Parties to reduce GHG emissions, was adopted at the Third Session of the Conference of Parties (COP 3) to the UNFCCC. Under the Protocol,⁵ Annex I countries have a legally binding commitment to reduce their collective GHG emissions by an average of 5.2% compared to 1990 levels during the period 2008-2012.

The Convention and, by extension, the Kyoto Protocol acknowledges the historical responsibility of developed countries for the causes of climate change. There are, therefore, no reduction commitments for developing countries. However, developing countries are able (and encouraged) to voluntarily contribute to global emissions reductions.

The Kyoto Protocol adopted three mechanisms, known as “flexibility mechanisms” whereby Annex I⁶ countries have three options by which to achieve emissions reductions in the most cost-effective manner. These mechanisms are:

- Joint Implementation – transferring emissions allowances, also called Emissions Reduction Units⁷ among developed country Parties, linked to specific emissions reductions projects
- International Emissions Trading – trading of emissions allowances, also called Assigned Amount Units⁸ among developed country Parties
- The Clean Development Mechanism (CDM) – trading of emissions allowances, also called Certified Emissions Reductions⁹ (CERs) between developed and developing country Parties. The CERs are generated by emissions reduction projects which also contribute to sustainable development of the developing (Non-Annex I) host country Party. Resulting CERs are purchased by Annex I parties.

The rationale for the establishment of these mechanisms aimed at mitigating GHG emissions is based on the fact that GHG have a global climatic effect. Therefore, it does not matter where in the world the reductions are made, the global climate will benefit and emissions should be reduced where costs are lowest.

⁵ The Kyoto Protocol is also referred to as “The Protocol”.

⁶ In practice, Annex 1 of the Convention and Annex B of the Protocol are used almost interchangeably. However, strictly speaking, it is the Annex 1 countries that can invest in Joint Implementation / Clean Development Mechanism (JI/CDM) projects as well as host JI projects, and Non-Annex 1 countries that can host CDM projects, even though it is the Annex B countries that have the emission reduction obligations under the Protocol (CDMCapacity.org, 2002).

⁷ An “Emissions Reduction Unit” is equivalent to one (1) metric ton of carbon dioxide emissions reduced or sequestered arising from a Joint Implementation project.

⁸ An “Assigned Amount Unit” is equivalent to one (1) metric ton of carbon dioxide emissions reduced or sequestered arising from an international emissions trading project.

⁹ A “Certified Emissions Reduction” is the equivalent to one (1) metric ton of carbon dioxide emissions reduced or sequestered arising from a CDM project.

Empirical evidence from studies undertaken by the IPCC in its Fourth Assessment Report¹⁰ suggests certain trends in the global and regional climate:

- Eleven of the last 12 years (1995-2006) rank among the 12 warmest years in the instrumental record of global surface temperature (since 1850)
- New data since the Third Assessment Report show that losses from the ice sheets of Greenland and Antarctica have, very likely, contributed to sea level rise between 1993 and 2003
- Global average sea level rose at an average rate of 1.8 (range from 1.3 to 2.3) mm per year between 1961 and 2003. The rate was faster between 1993 and 2003, about 3.1 (range from 2.4 to 3.8) mm per year
- More intense and longer droughts have been observed over wider areas since the 1970s, particularly in the tropics and subtropics. Increased drying linked with higher temperatures and decreased precipitation have contributed to changes in drought regimes
- The frequency of heavy precipitation events has increased over most land areas, consistent with warming and observed increases in atmospheric water vapour
- Widespread changes in extreme temperatures have been observed over the last 50 years. Cold days, cold nights and frost have become less frequent, while hot days, hot nights, and heat waves have become more frequent
- There is observational evidence for an increase in intense tropical cyclone activity in the North Atlantic since around 1970, correlated with increases in tropical sea surface temperatures
- Consistent warming trends in all small-island regions have been observed over 1901 to 2004. The percentage of days having very warm maximum or minimum temperatures has increased considerably since the 1950s, while the percentage of days with cold temperatures has decreased¹¹
- The maximum number of consecutive dry days is decreasing and the number of heavy rainfall events is increasing
- Since 1995, all but two Atlantic hurricane seasons were above normal
- There was a mean relative rise in sea level in the Caribbean of 1 mm/year in the twentieth century.

Although in its initial stages the climate change debate was mainly concerned with GHG mitigation, it was realised that due to the inertia in the Earth's climate system, regardless of global efforts to significantly reduce GHG emissions, projected changes in global climate would continue to be observed with dire consequences for Small Island Developing States (SIDS) and low-lying coastal countries. As a result, it is now generally accepted that for the Caribbean subregion, the immediate priority in terms of responding to global climate change (GCC) is adaptation, although mitigation strategies are encouraged.

¹⁰ Intergovernmental Panel for Climate Change (IPCC) Fourth Assessment Report: Climate Change 2007.

¹¹ Peterson, T. C., et al., Recent changes in climate extremes in the Caribbean region, *J. Geophys. Res.*, 107(D21), 4601, doi:10.1029/2002JD002251, 2002.

B. THE SUBREGION'S RESPONSE TO CLIMATE CHANGE

Contributing less than 0.1% of global greenhouse gas emissions, the primary focus for the Caribbean's response to climate change has historically been adaptation. A series of separate, but strategically related, initiatives have served to rapidly advance the climate change adaptation agenda in the Caribbean, and to stimulate policy responses to address the anticipated impacts of GCC.

In 1994, the Caribbean embarked upon a course of action to prepare for the adverse effects of climate change through adaptation planning, and demonstrated its commitment to such planning by undertaking a series of initiatives designed to build capacity, assess vulnerability and mainstream adaptation planning into the decision-making and planning processes at the national and regional levels. The milestones in this process were, and are, still in effect:

- 1994: The 1994 United Nations SIDS Conference on Sustainable Development and the identification of climate change as one of the 14 priority areas in the Barbados Programme of Action to be addressed in order to ensure the sustainable development of SIDS
- 1994-1997: The decision to design and seek funding for a climate change adaptation project, and the eventual approval of funding for the project
- 1997-2001: The implementation of the Caribbean Planning for Adaptation to Climate Change (CPACC) Project
- 2001: The decision by the Caribbean Community (CARICOM) Heads of Government to establish the Caribbean Community Climate Change Centre (CCCCC)
- 2001-2004: The Adapting to Climate Change in the Caribbean (ACCC) Project
- 2004-2008: The Mainstreaming Adaptation to Climate Change (MACC) Project
- 2005: The establishment of the CCCCC
- 2006-2010: The Special Pilot Adaptation to Climate Change (SPACC) Project (implementation of adaptation measures).

II. PROJECT INFORMATION

A. PROJECT BACKGROUND

Caribbean societies are facing serious challenges in the interaction between the human population and the environment that sustains them – an underlying stress that is being exacerbated by climate change. Given the nature of their economies, they are particularly vulnerable to the impacts of natural disasters that can result in widespread destruction of the productive economy, mainly through the capital stock. The interruption of the production of goods and services can be particularly devastating in an environment where few large sectors, such as agriculture and tourism, dominate the economic landscape.

At the 13th Meeting of UNFCCC, it was recognised that there is a need to:

- Assess the impacts of climate change on development in Latin America and the Caribbean
- Understand the distribution of these impacts within the Latin America and Caribbean region, given its diverse geographical, economic and social structures and the special needs of the Caribbean SIDS
- Mobilise decision makers to undertake specific actions to address these impacts.

As such, a project document entitled “Review of the Economics of Climate Change in the Caribbean” has been jointly prepared by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) Subregional Headquarters for the Caribbean and the Department for International Development (DFID) of the United Kingdom of Great Britain and Northern Ireland.

B. PROJECT OBJECTIVE

The ultimate direct objective of the project is to assess the likely economic impacts of climate change on key sectors of the Caribbean¹² economies, and to stimulate actions by governments, regional institutions and the private sector to develop and implement policies to mitigate and adapt to climate change. Once the net costs of climate change impacts have been assessed for a given sector, it would become possible for decision makers to value the benefits of adaptation to those impacts. The gross benefits of responding to climate change can be quantified in terms of the reduced costs of the impacts of climate change and, by assessing the resource costs of different adaptation or mitigation options (policies or programmes), it can be determined which option (if any) offers the greatest benefits relative to costs.

C. PROJECT PHASES

The project consists of three phases, the first of which establishes the scope and feasibility of carrying out a study on the costs and benefits of taking action on climate change adaptation and the cost effectiveness of mitigation in the Caribbean, compared to a “business as usual” scenario. This phase is also aimed at supporting initial actions to alert policymakers and key influencing constituencies in the Caribbean to the urgency of the climate change challenge.

¹² In this context, “the Caribbean” refers to the following island economies: Anguilla, Aruba, Antigua and Barbuda, the Bahamas, Barbados, the British Virgin Islands, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Montserrat, the Netherlands Antilles, Puerto Rico, Saint Lucia, St Kitts and Nevis, St Vincent and the Grenadines, Trinidad and Tobago and the United States Virgin Islands. It also includes Suriname, Belize and Guyana which, whilst non-islands, are usually considered small-island developing States (SIDS) as they have “island-like” features. The French overseas territories of Martinique and Guadeloupe are not associated with the ECLAC Subregional Headquarters for the Caribbean.

The second phase is expected to provide country-by-country assessments of the impacts of climate change on Caribbean countries; the third phase is aimed at broadening these assessments by incorporating multiplier effects caused by regional interdependence, and will ultimately feed into an analysis of the costs and benefits of climate change mitigation and policy recommendations for countries and regional bodies.

This review for the Caribbean forms part of a series of related climate-change initiatives that are currently being carried out by ECLAC in Central and South America and the DFID at a global level. It is anticipated that the results of these studies, in conjunction with the ECLAC studies on climate change in Central and South America and other regional studies, will contribute to a better understanding of the economic impact of climate change in Latin America and the Caribbean. It will also outline the costs and benefits of needed related policy responses, both in terms of mitigation and adaptation.

D. APPROACH TO THE PREPARATION OF THIS REPORT

A consultant from Barbados was contracted by the ECLAC Subregional Headquarters for the Caribbean for the period 1 October 2008 to 19 December 2008, to undertake the preparation of this report. Field work missions were conducted in nine selected Caribbean countries, including six CARICOM member States; (Barbados, Guyana, Jamaica, Montserrat, Saint Lucia, and Trinidad and Tobago), two Dutch territories (Aruba and the Netherlands Antilles) and the Dominican Republic. See Table 1 below for the schedule of consultations.

The ECLAC Subregional Headquarters for the Caribbean liaised with ministries of foreign affairs in all the participating countries to select key stakeholders to be consulted or to participate in consultations. These stakeholders included national governments (including climate change focal points in relevant ministries, climate change working groups, UNFCCC national communications working groups), regional organizations, civil society, academia and the United Nations system.

Focal points were asked to identify two persons from each respective country to be a part of the Advisory Committee for the project. It was recommended that these be high-level personnel from agencies responsible for finance, and climate change or environment. This committee was intended to approve the appointment of the Review Leader and consulting team, as well as the findings of the scoping study and final report.

Consultations were held either with larger groups or by means of a series of face-to-face meetings. Persons met were asked to provide information on data and studies related to climate change in their country, and in some cases, these were provided in hard or soft copies.

The scoping exercise also considered studies and initiatives related to weather extremes and sustainable development, since such activities are inherently related to a response to climate change. These initiatives are also important in defining the country-specific “business-as-usual” context. The report was also informed by similar and other relevant exercises in some of the participating countries.

Table 1
Schedule of consultations

Country	Date(s) of Consultations
Southern Cone	
Guyana	October 6 and 7
Aruba	October 9
Netherlands Antilles	October 10
Trinidad & Tobago	October 31
Central Cone	
Montserrat	October 13
St. Lucia	October 15
Barbados	October 17
Northern Cone	
Jamaica	October 21 and 22
Dominican Republic	October 23 and 24

E. STRUCTURE OF THE REPORT

This document has been prepared as a result of initial activities in Phase I only. More specifically, the document includes:

- A mapping of the studies that have been undertaken on climate change in the Caribbean
- The institutional framework that exists in each country to facilitate research and action on climate change
- An analysis of the current state of research on climate change in the Caribbean and a needs assessment for future research
- Individual country reports for countries in which field work missions were conducted.

The individual country reports are presented in alphabetical order and the following components are represented:

- Introduction
- Overview of the country's participation in the climate change debate
- Institutional framework to address climate change
- Legislative and policy framework related to climate change
- Key vulnerable sectors
- Overview of research and studies on climate change
- Other initiatives relevant to climate change
- Research needs and gaps
- Conclusions and recommendations
- List of persons participating in the consultations.

Finally, a summary and conclusions as well as recommendations for the Caribbean, based on the experiences in the nine countries, are provided.

III. COUNTRY REPORTS

Country reports for each of Aruba, Barbados, Netherlands Antilles, Dominican Republic, Guyana, Jamaica, Montserrat, Saint Lucia and Trinidad and Tobago are presented in this section. The information has been garnered from the results of in-country stakeholder consultations, additional discussions with select stakeholders and desk research on initiatives and legislation in the respective countries.

Each country report comprises the following sections:

1. Introduction and brief summary of the discussions
2. Country overview
3. Overview of country's participation in international and regional climate change responses
4. Institutional framework to address climate change
5. Legislative and policy framework to address climate change
6. Key sectors
7. Overview of research and studies on climate change
8. Other initiatives relevant to climate change
9. Relevant data on country
10. Needs and gaps
11. Conclusion and recommendations
12. List of participants at the consultation(s)

ARUBA



Source: <http://www.worldtravelguide.net/country/18/map/Caribbean/Aruba.html>

A. ARUBA

1. Introduction and brief summary of the discussions

Meetings with stakeholders took place at the Playa Linda Beach Resort on 9 October 2008. During the morning session, introductory remarks were delivered by Mr. Agustin Vrolijk, Director of the Department of Foreign Affairs, and policymakers from the Government of Aruba were in attendance. At the beginning of this session, ECLAC delivered three presentations on each of the Stern Review, the RECC and adaptation to climate change in the Caribbean. The afternoon session, which comprised representatives of civil society organizations, was opened by Mr. Byron G. Boekhoudt, Policy Advisor for the Ministry of Labour, Culture and Sport.

It was clear that the Government of Aruba had not previously participated in any specific climate change initiatives prior to this project's consultation. Participants agreed that there was some level of awareness of climate change and its potential impacts at the level of government agencies, but this was very limited and not targeted at those stakeholder groups which could effect the most significant response, namely the private sector and policymakers.

There appears to be little interaction between the Government of Aruba and the private sector on environmental issues. Climate change and other environmental issues should be linked directly to finance/economic policies.

It was recommended that government, as the regulatory mechanism, should act as the agent of change as well as develop and implement policies geared towards behaviour change that would reduce vulnerabilities to climate change, (e.g. coastal setbacks) and dependency on fossil fuels (e.g. more support for renewable energy initiatives). Apart from a lack of general awareness on climate change, the main factors causing this inertia are:

- The fact that policymakers do not have enough information about specific country and sectoral impacts, as well as the costs associated with them in order to make better informed policy decisions
- International loans are easier to attain for the development of fossil fuel industry than for investment in renewable energy.

Similarly, there appears to be little regard by policymakers for the high use of fossil fuels in Aruba. Aruba's main source of energy to produce electricity is imported fossil fuels. However, it is expected that 10 wind turbines would be installed at Vader Piet and these should be operational by December 2009. Aruba's electrical power is generated at the water desalinisation plant, along with the fresh water supply. Cars are still easily affordable and car loans are also easy to acquire. Many Arubans would like to see a significant improvement in public transportation in order to encourage its wider use.

Generally, apart from the hotel industry, the private sector was not aware of climate change issues. However, through its institutional mechanisms and spheres of influence, it is well placed to disseminate relevant information on climate change. Seven hotels in Aruba are Green Globe certified. With the growth in popularity of the environmentally-friendly tourism product in the marketplace, "green management" is now a key marketing tool. One luxury hotel is also using solar energy for electricity generation, rather than for water heating alone. Despite the limited private sector targeted awareness specific to climate change, many nationals are experiencing more subtle climatic changes, such as: the

experience of more intense sunshine which has led to an increased use of shade-house¹³ agriculture to protect crops; and water reserves being less available than in the past.

As a result of their “Status Aparte” from the Kingdom of the Netherlands it was perceived that Aruba did not benefit from its association with the Kingdom as much as the other Overseas Territories.

Those present at the consultations committed to participating in a National Climate Change Committee.

2. Country overview¹⁴

Aruba is a small island (approximately 192 km²) located in the southern Caribbean. The island is an autonomous member of the Kingdom of the Netherlands. With a population of about 103,484 people (in 2006), the population density is about 575 people/km² and is among the highest in the region. The island has a tropical marine climate, with an average annual rainfall around 409 mm/yr. The landscape is arid with limited vegetation comprising cacti and local savannah trees, and limited agricultural activities.

Aruba has a relatively short economic development history. In 1910, oil was discovered in the Lake of Maracaibo, Venezuela. Shortly after, in 1928, Lago Oil & Transport Ltd. established and started its operations on the island, due to Aruba’s strategic location near the Lake. The oil company made large investments in infrastructure and telecommunications, setting up health and education systems and providing jobs for a large proportion of the local population. This resulted in attractive conditions for business and attracted further foreign investments that led to many types of service-oriented businesses being established. In 1984, the oil company decided to stop its operations due to increases of the well head oil prices, and this sudden crisis provided the incentive for the Government of Aruba to facilitate investment in a newly identified, and still to be revived, economic sector, namely tourism.

Due to Aruba’s beautiful, pristine coastal environment and pleasant climate, and its friendly people, the tourism industry was a success. The Gross Domestic Product (GDP) increased from US\$457 million in 1986 to about US\$2,286 million in 2006 mainly driven by investments in hotels, infrastructure and other tourism-related activities. Two decades of rapid increase in economic activities and trade resulted in Aruba’s population expanding rapidly from 63,000 to about 100,000 people (1.5% annual average growth rate) in the period 1986 to 2006. The economy also grew, keeping pace with the increase in population, resulting in a GDP per capita of about US\$22,860 (2006).

Historically, Aruba was part of the Netherlands Antilles, a six-island federation which also included Bonaire, Curaçao, St. Eustatius, St. Maarten and Saba. This island grouping, in turn, formed the Caribbean component of the Kingdom of the Netherlands, a constitutional monarchy with the Queen of the Netherlands having the dual role of head of State of the Kingdom of the Netherlands, as well as of the country of the Netherlands.

On 1 January 1986, Aruba obtained its “Status Aparte”, thereby enabling it to become a separate entity within the Kingdom of the Netherlands. Aruba continues to maintain direct ties with the Kingdom of the Netherlands, but has complete autonomy over its own internal affairs, while the Kingdom is constitutionally responsible for defence and external affairs, among others. Aruba’s current status does not represent full independence for the island.

¹³ This is similar to “greenhouse agriculture”, but the shade-house protects cultivated plants from the excessive heat and light from the sun; whereas the greenhouse traps the incoming solar radiation to create warmer and moister conditions for the plants, in climates which are generally cooler than the tropics.

¹⁴ Source: Kevin de Cuba (2007) Climate Change Impacts and its Impacts on the Livelihoods of Aruban People.

3. Overview of Aruba's participation in international and regional climate change responses

Aruba has not signed the UNFCCC and, consequently, has also not signed the Kyoto Protocol. However, the Nature and Environment Policy Plan 2004-2007 (approved by the Council of Ministers in 2004) indicates the intention of the Netherlands Antilles and Aruba to ratify this Convention. In the Caribbean, only Aruba and Cuba have updated their legislation to incorporate climate change issues. The Kingdom of the Netherlands has ratified both international agreements and submitted their Fourth National Communications, which does not include any information from the Overseas Territories.

The Government of Aruba has also not participated in any Caribbean regional climate change projects. However, local non-governmental organizations such as Rainbow Warriors International and Acción Ambiental both participate in Earthday Network's Climate Change Campaign to raise awareness about climate change issues since 2005. With respect to per capita GHG emissions, several nations and territories in the Caribbean (the United States Virgin Islands, the Netherlands Antilles, Aruba, Trinidad and Tobago, the Cayman Islands and Bermuda), as well as Venezuela, all oil producers, are among the 60 main emitting countries.

4. Institutional framework to address climate change

Table 2 shows the institutional structures (mainly governmental) that currently can participate in climate change responses in Aruba, as well as regionally.

Table 2
Institutions in Aruba with responsibilities linked to climate change

Agency	Responsibility	Scope
Department of Agriculture, Husbandry and Fisheries	Overall management of the agricultural sector	National
Ministry of Economic Affairs, Tourism, Social Affairs and Culture	National Parks	National
Meteorological Services of the Netherlands Antilles and Aruba	Meteorological, hydrological and climatological services	Regional
Department of Infrastructure and Planning	Infrastructural and land-use planning	National
Prime Minister's Office	Crisis management	National
Ministry of Labour, Culture and Sport.	National parks	National
Aruba Hotel and Tourism Agency (AHATA) - Environmental Committee	The Aruba Hotel & Tourism Association is the recognised private sector voice and representative organization for the private sector hospitality and tourism industry. Its strength is derived from the combined energies of its 110 members, representing hotels, time share resorts, casinos, restaurants, attractions, car rental companies, special events experts. Additional and extensive support is received from its members representing professional services from the financial, accounting, legal, educational and training sector as well as a variety of retail and supply companies. For more than four decades it has made significant contributions by bringing together private sector ideas and funding in support of Aruba's tourism industry	National

Agency	Responsibility	Scope
	<p>and community at large. It is fully in the business of destination marketing where 75% of its budget is invested (all aimed at bringing greater numbers of quality customers to Aruba).</p> <p>The Environmental Committee consists of members and representatives from several resorts, local businesses, Aruba Gastronomic Association (AGA), the Animal Rights Aruba (ARA) & government entities. The committee's task is foremost to create awareness of sustainable development and to safeguard the fragile environment for the public especially the resorts and school kids.</p>	
Fundación Acción Ambiental	Participates in Earthday Network's Climate Change Campaign since 2005 in collaboration with Rainbow Warriors International	Local and Regional
Rainbow Warriors Core Foundation (Rainbow Warriors International)	Participates in Earthday Network's Climate Change Campaign since 2005, World Resources Institute and UN activities. Through its own programs and regionally through the Whitewater to Bluewater (WW2BW) partnership subprogramme Southern Caribbean Ecoregion Initiative alliance.	Local, regional and global
Dutch Caribbean Nature Alliance	"To safeguard the biodiversity and promote the sustainable management of the natural resources of the islands of the Dutch Caribbean, both on land and in the water, for the benefit of present and future generations, by supporting and assisting the protected area management organisations and nature conservation activities in the Dutch Caribbean".	Regional – Dutch Caribbean

5. Legislative and policy framework to address climate change

(a) National Integral Strategic Plan 2025

The Government of Aruba is committed to developing an integrated long-term plan that would guide the country's development to 2025 (Nos Aruba 2025). The plan contains a national vision regarding sustainable development, the formulation of national goals, a method to execute these national goals and detailed actions for implementation. The plan also includes long-term strategies at a national level which are obtained with an interdisciplinary and multisectoral approach.

This process is being implemented using the Appreciative Inquiry approach in the "Nos Aruba 2025 Project" (see www.nosaruba2025.aw) to garner active stakeholder and sectoral inputs. The process unfortunately does not adhere to any recognized framework of reference for sustainable development as confirmed by the key consultant from Wikima Partners, Ms. Romy Shovelton. Thus, the recommendations will not be embedded within any recognizable structure as would be recommended by the United Nations for a national strategy for sustainable development, with no structural reference to the Barbados Programme of Action for SIDS, the Mauritius Strategy (MSI) documents, 2005 Mauritius summit for SIDS documents, Millennium Development Goals and any recommendations from either UNFCCC, UNEP, Convention on Biological Diversity (CBD), WMO, United Nations Development Programme (UNDP), Food and Agriculture Organization (FAO), United Nations Educational, Scientific

and Cultural Organization (UNESCO) or other international bodies with regard to climate change and climate adaptation issues.

These long-term strategies will be formulated within the framework of a National Integral Strategic Plan (NISP) that directly and indirectly influences sustainable development in Aruba. In particular, they will ensure that the key sectors and functions of tourism, education, special planning, infrastructure development and environmental management are well integrated into the plan and that these sectors support, rather than retard the development of one another. During the process of the formulation of the NISP, various guidelines have been established, within which the economic, environmental and social elements of development planning are to be coordinated. It is intended that the document will include climate change as a cross-cutting issue for all sectors and will be completed in November 2009.

(b) Spatial Development Plan Aruba

On 6 October 2006, the Landsverordening Ruimtelijke Ordening or Law on Spatial Development was proposed as an important step in the direction of sustainable development in Aruba. This law will dictate land use in Aruba in a more sustainable way and is supported by the Ruimtelijk Ontwikkelings Plan (ROP – Spatial Development Plan) which represents Aruba in zones of preferential land use and development for the next 10 years. The first ROP for Aruba was completed in June 2009. Global warming and its consequences have not been issues in the development of the document, but will be considered after expert input.

(c) Framework Environmental Legislation

- Building codes: Aruba, having no particular building codes, has used Dutch and American specifications since 1972, but by 2010 the Kingdom of the Netherlands will adopt and enforce the new EUROCODE, as it is now part of the European Union
- Coastal Zone Management Aruba (CZM): this legislation is in the drafting stage. There is a building setback policy for construction in the coastal zone but it is not enforced.

(d) Green Projects Legislation

An instrument to stimulate environmentally beneficial or nature conservation activities, particularly from the private sector but also from NGOs, is Dutch tax legislation called “Green Projects (Netherlands Antilles and Aruba) Regulations” which is an extension of the Dutch Green Projects Regulation which sets criteria for “green projects” under the Dutch Income Tax Act. Although this is a Dutch regulation, it offers environmentally friendly projects a strategy for realising low interest financing from Dutch “Green Funds” maintained by several banks in the Kingdom of the Netherlands. In order to be eligible for such “green funding”, a “green certificate” from the Dutch Department of Public Housing, Area Planning and Environment is required. The application for green certification is handled by the particular “Green Fund” that is interested in financing the project. In the decision procedure for certification, the Ministry of Public Health and Social Development has an advisory role in order to assure that the project in question sufficiently meshes with established environment and nature conservation policy in the Netherlands Antilles.

6. Key sectors

The sectors and systems identified as most vulnerable are tourism, water and sanitation, sewerage and water treatment, air transport, human settlements and health.

7. Overview of research and studies on climate change

As there have been no climate change projects in Aruba, neither technical impact studies nor assessments have been prepared. However, in 2007 an article entitled “Climate Change and its impact on the livelihood of the Aruban People” was prepared¹⁵. The thesis examines the projections from global models on the Caribbean and includes local observations of increases in sea surface temperatures and atmospheric temperatures that support these projections. Climate campaigns exist in the NGO community since 2005, namely those of Acción Ambiental and Rainbow Warriors International but, because of financial constraints, these do not focus on data collection, impact studies or assessment.

8. Other initiatives relevant to climate change

(a) Green Globe 21 certification

Seven hotels in Aruba have achieved this standard for sustainable travel and tourism operations. The “Green” Hotels are properties whose managers are eager to institute programmes that save water, save energy and reduce solid waste, while saving money.

(b) ISO 14000 Certification

Some private sector companies have achieved this level of certification. This means that the organization implements measures to minimize harmful effects on the environment caused by its activities, and to achieve continual improvement of its environmental performance.

(c) Ban the Plastic Bag Awareness Group

This is a campaign to raise awareness of the damage that non-degradable plastic bags can cause if improperly disposed of, and their impact on landfills.

(d) Sustainable Aruba

The objective of Nos Aruba 2025 is the institutionalization of an integrated and strategic planning process, where the coordination among the relevant stakeholders is encouraged taking into consideration guidelines for sustainable development.

(e) Eagle Beach Area Coalition for Aruba’s Sustainable Tourism

This is an initiative to preserve and maintain the Eagle Beach area of the island through roadside and beach clean-up projects as well as training. The organization also oversees a recycling programme, participates in the sponsor-a-mile programme, and supports volunteer work during the turtle-nesting season. EBA-CAST is also a co-sponsor of the Annual Aruba Reef Care Project, another important effort launched nine years ago by the Aruba Tourism Authority. This yearly project brings together volunteers, divers, topsiders and snorkelers to collect litter from area beaches and dive sites.

There are also several campaigns from Acción Ambiental and Rainbow Warriors International aimed at raising awareness of climate change and climate adaptation issues.

¹⁵Source: Kevin de Cuba (2007), Climate Change Impacts and its Impacts on the Livelihoods of Aruban People, Center for International Environmental Law, Washington, D.C., USA. Available at: http://www.ciel.org/Climate/Climate_Impacts.html

9. Relevant data on Aruba

(a) Meteorological data

The Meteorological Services of the Netherlands Antilles and Aruba (<http://www.weather.an/>), based in Curaçao, is the central data repository for climate data on Aruba. These datasets include temperature rainfall, and wind, but not sea level. Rainfall measurements for Aruba have been collected since 1901.

(b) Comprehensive socio-economic data

- United Nations statistical website (<http://unstats.un.org/unsd/default.htm>)
- Aruba's Central Bureau of Statistics (CBS – <http://www.cbs.aw/cbs/home.do>) is the institution officially assigned with the collection, processing and publication of statistics to be used by policymakers, especially for research in different areas. It is a government department that resides under the jurisdiction of the Ministry of Finance and Economic Affairs.

10. Needs and gaps

(a) Public awareness

There has been some public government agency-issued, or –distributed, awareness initiatives about climate change in Aruba, but it has not been consistently delivered and has lacked country-specific impacts and possible solutions. A booklet on hurricane-related information was prepared and circulated. However, a survey to assess how well this tool was received, showed a low percentage among adults but higher among schoolchildren. Aruba does not have a historical reading culture so any successful approaches should be delivered via the radio and/or television.

The following are the target audiences requiring outreach:

- Private sector, which is not aware or unduly concerned about climate change, but can be used as a mechanism to disseminate information among one another
- Policymakers: In Government, there may be awareness of climate change among technocrats, but it is not adequately communicated to policymakers for action. Furthermore, no impact studies have been conducted for Aruba.

(b) Data

Sea level, sea surface temperature, bathymetry and tidal data are needed.

(c) Research on renewable energy

This should be spearheaded by government as it is recommended that they could be agents of change. Pilot studies that demonstrate clean energy, or adaptation in the most vulnerable areas or sectors are also needed.

(d) Impact modeling/inundation scenarios

Policymakers are more likely to respond to visual representation of impacts based on sound science.

(e) Baseline studies

These are needed for terrestrial and marine ecosystems as well.

(f) Human/technical and financial resources

Capacity-building for implementation of the national obligations under the UNFCCC is required.

(g) Collaborative approach

Collaborations are necessary for the Netherlands Antilles and Aruba to better respond to climate change.

A few opportunities already exist in Aruba to address some of the above-mentioned needs:

- Weather section in national newscasts
- The Government's website has a "Climate section" where information on climate change may be posted
- The Ministry of Agriculture, Husbandry and Fisheries may encourage and support student research on climate change impact studies for this sector.

11. Conclusion and recommendations

There is an opportunity for the development of a climate change agenda for Aruba. However, it was expressed that a regional (Netherlands Antilles) approach is preferable. This would necessitate the convening of a regional consultation to establish a framework for defining national and regional priorities. This process can be greatly enhanced through the shared experiences of CARICOM countries in their efforts to respond to climate change.

Given the imminent political status for these Caribbean territories, Bonaire would continue to have better direct access to funds from the Kingdom of the Netherlands to support this approach. The champion identified to move this process forward in Aruba is Mr. Edward Malone¹⁶ from the Aruba Hotel and Tourism Association.

Additionally, a National Climate Change Committee should be established and members should include Mr. Malone as well as the participants at the consultations since they represent a broad stakeholder base. This committee would have to be appointed by the Council of Ministers.

The Dutch Caribbean Nature Alliance is the only regional environmental body and has demonstrated success in achieving its mandate. This organisation and its approach to regional implementation may be used to address energy and climate change issues in the Netherlands Antilles and Aruba.

¹⁶ Mr. Malone was not present at the consultations.

Table 3
List of participants at the consultations in Aruba

Name	Organization	Tel/Fax	E-mail
Leonard J Kelly	Department of Finances	732-1001	L.Kelly@finance.gov.aw
Nico Arts	Crisis Management Office	588-7843	Crisis.mgmt.off@setarnet.aw
Greg Peterson	A.T.I.A./Red Cross	582-0909	g.petersen@fzANV.com
Stanley Brown	K.V.K.	583-9039	Stanley@multimediaNV.com
Noud Fransen	Department of Infrastructural Planning	583-3000 / 564-5984	Arnoldus.Fransen@aruba.gov.aw noudfr@hotmail.com
Patty Portier	DLVV	285-8102	patricia.portier@aruba.gov.aw
Mark Oduber	Meteo	582-6497	mark.oduber@meteo.aw
Henry de Cuba	MISMA	593-3871	hencub@gmail.com
Ingrid Werleman	Aruba 2025	741-3300	ingridwerleman@gmail.com
Estella Brown -Thode	Aruba 2025		deaci@setarnet.aw
Merrill Robles	Advisory Body Flora & Fauna	582-2349	
Milton Ponson	Rainbow Warriors International	+297 568 5908	southern_caribbean@yahoo.com

BARBADOS



Source: <http://www.worldtravelguide.net/country/28/map/Caribbean/Barbados.html>

B. BARBADOS

1. Introduction and brief summary of the discussions

A meeting with stakeholders took place on 16 October 2008 at the Office of the Ministry of Tourism Affairs. The meeting started with opening remarks by a representative of the Ministry of Family, Sport, Youth Affairs and the Environment¹⁷ and the delivery of presentations on the Stern Review, the RECC and adaptation to climate change in the Caribbean by ECLAC.

The recent flooding in Barbados was not so much attributed to climate change as to poor drainage systems. The suck-wells are poorly designed, gullies and waterways are filled in and built on, and the drainage infrastructure is inadequately maintained. A proposal to replace the mains has been submitted to Cabinet many times, but has not been approved as it would be quite costly (US\$360 million).

The Department of Emergency Management facilitates national disaster response on the island, through the disaster mitigation framework of the Caribbean Disaster and Emergency Management Agency (CDEMA),¹⁸ and has responsibility for disaster mitigation in all sectors. The implementation of sectoral strategies is facilitated through standing committees in each sector and the approach has shifted from response and recovery to include prevention. The National Disaster Policy was approved in 2003 and the disaster mitigation framework was reviewed in 2006 and 2007. This led to the revision of the legislation to consolidate a number of laws and regulations.

Barbados, like other Caribbean countries, is heavily dependant on petroleum imported from Mexico and Venezuela for its energy production. Domestic natural gas production currently meets local demand. Barbados has estimated natural gas reserves of 141.4 million cubic metres, with an annual consumption of 29.17 million cubic metres.

The government has committed to having renewable energy account for 30% of the island's primary electricity by 2012. However, due to the high price of fuel imports, it is trying to achieve this target earlier. Bagasse and solar water heaters contribute 15% of the island's primary energy supply. Currently, the government is looking to expand the number of sources of renewable energy, which will include wind energy and fuel cane. This commitment is demonstrated through the following:

- The Ministry responsible for the Environment has one vehicle which is being tested with compressed natural gas (CNG). It is intended to have a small fleet using CNG within the next two years, along with a CNG station for these vehicles
- The Barbados National Standards Institute is building capacity to deal with energy efficiency and renewable energy standards to inform the development of fiscal incentives
- The revised Barbados building code already includes energy efficiency benchmarks, but the code is not legislated and, therefore, compliance is not a legal requirement for development approval. As in many other Caribbean countries with limited personnel at the regulatory agency, there is often a discrepancy between the approved development plans and what is constructed.

According to the Draft Barbados National Energy Policy, government is looking to introduce gasohol based on a 10% ethanol to gasoline mix. Under the reform of the sugar industry, it intends for

¹⁷ This is the UNFCCC focal point Ministry for Climate Change.

¹⁸ CDEMA has now been renamed to the Caribbean Disaster, Emergency and Management Agency (CDEMA).

approximately 14.7 million litres of ethanol to be produced annually to meet that requirement. The levels of ethanol content in the gasoline are to be progressively increased over the 20-year design period. Recognising that ethanol can be used in the production of biodiesel, government has pledged to encourage further investment in ethanol production.

Barbados consumes approximately 100 million litres of diesel annually. Government has also proposed in the draft policy to mandate that the 2% biodiesel content for all diesel-fuelled vehicles by 2012 be increased to 10% by 2025. An estimated 4.5 million litres of used cooking oil generated annually can be converted into biodiesel. Government has expressed the intention of providing incentives to the private sector for the development of the biodiesel industry.

Barbados is classified as a water-scarce country and it is currently utilising 98% of its rechargeable resources of fresh water. Based on projections of reduced precipitation for Barbados, increasing storage capacity and expanding desalination facilities are feasible options to meet local demand with a declining supply. A desalination plant became operational in 1999 to augment the potable water supply (10% reserve capacity) and mitigate against drought. This plant is located on the coast which is vulnerable to climate change impacts. The plant has been specifically designed to reduce the overall energy requirements and provide high quality potable water. It combines advanced membranes operating at low pressure into a single array, giving a typical indicative power consumption of around 1 kWh/m³ of product water. However, the current plant is strategically located and pumps brackish water from a system of faults where the fresh water and sea water lens meet. The input water quality is important and is considerably high at this location and, therefore, the expense to make it potable is acceptable. Assessments have been conducted to locate other possible sites for desalination but water quality is very poor.

Future scenarios must also be addressed on the demand side action and this has been effected through public service announcements to conserve water, the prevalence of drip irrigation rather than sprinkler systems, the legal requirement under the Town and Country Planning Act, to install a rain-water storage tank for new residential development for flushing toilets.

In terms of waste-water treatment in Barbados, there are two plants – one in the capital, Bridgetown, and another on the south coast. The latter is more modern but both provide primary treatment only and release the treated waste far off the coast. While the output meets the World Health Organization (WHO) standards for suspended solids, there are chemicals from antibiotics and hormones which can be detrimental to the marine environment, if not regulated. Another treatment plant is planned for the west coast and this is expected to provide at least secondary treatment. There has been an increase in algal blooms in Carlisle Bay on the west coast but the exact cause is uncertain.

In light of the existing stresses on natural resources and, particularly, the marine environment in Barbados, climate change will indeed exacerbate them. It will have an adverse impact on the dilution process which is used to treat sewage. This process works well with strong currents but climate change is changing this dynamic, due to carbon dioxide fertilisation of the ocean, which changes the density of the sea water.

The Environmental Protection Department is the regulatory body for pollution but there is no environmental legislation. It is currently drafting a policy paper on clean air.

The Ministry of Agriculture is exploring the sourcing of new genetic material to adapt to new climatic conditions. Additionally, where slight temperature increases (being experienced currently) can affect an entire industry, there is opportunity for the use of photovoltaic cells to power wind tunnels on poultry farms, which are now being powered by diesel. The Ministry is also increasing the use of shade

houses, and supports the development of feedstock production for biofuels, suggesting that there need not be competition between food and fuel.

The Ministry of Foreign Affairs works with the focal point ministry for climate change to examine the politics of climate change; more specifically, the actions (and inactions) that affect the ability of Barbados to achieve its national development goals.

The Caribbean Youth Environmental Network strongly promotes the involvement of young persons in sustainable development activities. They are implementing a two-year project (due for completion in December 2008) with the goal to make the youth sector (15-25 years old) of the Caribbean, aware of the impacts that climate change could have on the national development of Caribbean States. The programme educates youth about climate change issues in such a manner that, as they get older and become decision makers and agents of policy development, their thinking will automatically take climate change issues into consideration. In addition, the project has generated data to show that the electrical power output from the national grid can be reduced and, by extension, the burning of fossil fuels by generators, through simple available technologies. In this regard, the project used pilot studies focused on electricity consumption in low-income housing, specifically aspects related to lighting, to demonstrate how energy conservation at the unit domestic level can be achieved at the national level.

The insurance industry in Barbados has been using the existing building code (though not legislated) to guide their risk management process. Therefore, some companies would not insure properties that do not comply, as it is more beneficial to forego the premiums than to pay out for property losses. There was crop insurance for sugar cane in the past, but pay-outs were too great for the industry and they have discontinued this product. In some instances, crop-loss insurance is through self-insurance, for e.g. Windward Island Crop Insurance, which is a compulsory banana insurance programme that was introduced in 1987-1988 by the banana marketing boards of the four Windward Islands. It protects more than 25,000 growers against wind damage. Also, the Barbados Light and Power Company Limited could not buy insurance for their utility poles, so the company itself insures them.

Early responses to climate change for SIDS were focused on adaptation. Now, with the rest of the world asking everyone to mitigate, the question is arising on the rationale for SIDS to invest limited resources into this. More specific to this project, the key scenarios that will guide the cost benefit analysis for Barbados must be clarified. Sir Nicholas Stern drew on the IPCC storylines from the Fourth Assessment Report, but the ultimate approach depends on the post-Kyoto talks coming out from the Conference of Parties meeting in December 2009.

2. Country overview

Barbados, the most easterly of the islands of the Lesser Antilles, is a small island developing State of area 431 km², located in the Atlantic Ocean, at 13° 4' north latitude and 59° 37' west longitude. It is bordered by the Caribbean Sea on the west coast and the Atlantic Ocean on the east, with a coastline of 97 km, and an exclusive economic zone of about 167, 000 km².

Barbados experiences a tropical, oceanic climate, with a mean annual temperature of about 29.67°C, the highest temperatures (generally about 31°C) being experienced in the summer months of May to September. There is a marked dry season from December to May (peaking in February-March), where mean rainfall is about 50 mm per month; and a wet season from June to November, when monthly rainfall can more than triple that of the dry season.

Since gaining independence in 1966, prudent political governance and economic management have facilitated the transformation of Barbados from an agrarian-based economy to a more diversified one

which is characterised by light to semi-heavy manufacturing and services. Over the years, tourism and financial services have grown from insignificant levels to become major contributors to GDP, employment generation, and the country's capacity to earn foreign exchange.

Barbados' economic and social development is grounded in stable government, democratic freedoms, the advancement of human rights, an independent and fair judicial system, a well-educated and trainable labour force, and sound economic management. The link between the environment and economic concerns cannot be overemphasised. Natural resources in Barbados are essential in providing services to the economy. The economy in Barbados is dependent on tourism, and degradation of natural environmental resources will lessen the revenues and foreign exchange earnings.

Barbados exhibits many of the special characteristics that are peculiar to small island States. The country has a limited natural resource base that is already heavily stressed from unsustainable human activities. As a consequence of its small size, there is a high susceptibility to natural disasters such as tropical cyclones and droughts. Barbados has an extremely high population density which generally increases the environmental vulnerability. Since the main source of potable water is from underground aquifers, many of which are in the coastal zone, some are susceptible to saline intrusion. This is especially so where there are relatively thin water lenses on the west coast of Barbados.

For SIDS, like Barbados, solid waste management is a serious challenge with respect to environmental management. Barbados is 431 km² and has a population of approximately 266,800. Land resources are limited and this, along with a growing population, make sustainable waste management even more challenging.

Point sources and non-point sources of pollution continue to affect local terrestrial and marine biodiversity. There has been particular decline in near-shore habitats due to the rapid expansion of development along the coasts.

For all practical purposes, Barbados relies on imported refined product to meet nearly all (about 95%) of its power and transport fuel needs. Less than 15% of the refined product comes from domestic oil production. Domestically produced natural gas provides less than 5% of total energy needs. In the 1950s when 22 sugar factories were in operation, Barbados generated 50% of its energy from renewable sources.

3. Overview of Barbados' participation in the international and regional climate change responses

Barbados, a developing (Non-Annex I) country, ratified the UNFCCC in March 1994, and acceded to the Kyoto Protocol in August 2000. The country submitted its first National Communication to the UNFCCC Secretariat in 2001 and is now in the process of preparing its Second National Communication.

The emphasis for island countries with respect to domestic policy has been on adaptation. In this regard, Barbados is already well advanced in terms of both the analysis of coastal impacts and in the preparation of an institutional and planning framework for CZM. In the last two and a half decades, Barbados has undertaken three major coastal zone management projects with assistance from the Inter-American Development Bank (IDB). These projects, which have included coastal vulnerability analyses, have culminated in a Coastal Zone Management Plan for the entire coastline. Design standards for coastal structures and setbacks have been developed, taking into account assumed future changes in sea level, flooding associated with 50-year and 100-year storm events and, in the case of setbacks, projections for shoreline erosion. Setback policies are also incorporated into the Physical Development Plan (2003).

In addition, Barbados has participated in several regional projects. The CPACC project was developed to support Caribbean countries in preparing to cope with the adverse effects of global climate change particularly sea level rise in coastal and marine areas, through vulnerability assessment, adaptation planning and related capacity building. The project was executed in 12 CARICOM member countries over the period 1998-2001. Studies conducted by the CPACC project have concluded that the socio-economic sectors and the biological environment of Barbados are vulnerable to the expected impacts of climate change, namely: increases in atmospheric and sea surface temperatures, rising sea levels, changes in rainfall patterns and possible increases in the intensity of tropical storms. More specifically, adverse impacts would be experienced in the health, tourism, finance and agricultural sectors, human settlements, and terrestrial and marine systems.

Barbados has also participated in the follow-up regional climate change project – the ACCC project, which was implemented from 2001 to 2004. Whereas, Barbados did not participate in any of the two pilot projects implemented under this project, benefits were gained from the processes undertaken and outputs achieved at the regional level.

The third Caribbean regional climate change initiative, the MACC project commenced in September 2003 and has just realized completion having been implemented in 12 CARICOM member States (including Barbados). The Vulnerability Assessment of the Barbados Tourism Sector occurred under the MACC project, the outputs of which are to be integrated within the National Multi-Hazard Disaster Plan for the tourism sector that is being developed by the Ministry of Tourism.

The climate change programme has brought together the work of several agencies to assist in meeting the objectives of the UNFCCC, as well as meeting the general objectives and targets set by the Government of Barbados.

4. Institutional framework to address climate change

Table 4 shows the institutional structure that currently participates in climate change responses in Barbados, as well as regionally.

Table 4
Institutions in Barbados with responsibilities linked to climate change

Agency	Responsibility	Scope
Ministry of Environment, Water Resources and Drainage	Comprising: <ul style="list-style-type: none"> ▪ Environmental Unit – which among other responsibilities specialises in environmental awareness and education, measuring and monitoring sustainable development, protecting and managing biodiversity, and the implementation of several Multilateral Environmental Agreements (MEAs); ▪ Barbados Water Authority ▪ Sanitation Service Authority ▪ Coastal Zone Management Unit (CZMU) – To develop and implement an integrated National CZM Plan, and to continue working to ensure that the coast retains its vital and pivotal role in the social and physical development of Barbados. ▪ Environmental Protection Department – a technical department whose responsibilities include environmental monitoring of the marine 	National

Agency	Responsibility	Scope
	<p>environment, the air, water, noise as well as hazardous material management.</p> <ul style="list-style-type: none"> ▪ National Conservation Commission (NCC) – whose responsibility include the conservation of the natural beauty of Barbados; management of public parks, gardens, caves, and marine underwater parks; ▪ The Natural Heritage Department – a recently formed department to take over the responsibilities of biodiversity conservation, Harrison’s Cave, and other heritage and protected areas. 	
Ministry of Finance and Investment, Labour, Civil Service and Energy	<ul style="list-style-type: none"> ▪ Barbados National Oil Company ▪ National Petroleum Corporation 	National
Prime Minister’s Office – Town and Country Planning Dept.	Development Control and Forward Planning	National
National Climate Change Committee	<p>The Climate Change Steering Committee was established as one of the action points under the Institutional Strengthening project, and as articulated in the approved Barbados Country Programme, to assist with the execution of the Institutional Strengthening Project by using local experts from both the public and private sectors.</p> <p>The Climate Change Steering Committee’s key functions include, but are not limited to, the following:</p> <ul style="list-style-type: none"> ▪ The dissemination of information; ▪ Participating in public education and awareness initiatives; ▪ Assist the Atmosphere Programmes with technical and scientific information; and ▪ Act as liaison between government and the community. 	National
Ministry of Agriculture	Fisheries management, research, as well as training and extension.	National
Caribbean Community Climate Change Centre (CCCCC)	<p>The Caribbean Community Climate Change Centre coordinates the Caribbean region’s response to climate change. Officially opened in Belize in August 2005, the Centre is the key node for information on climate change issues and on the region’s response to managing and adapting to climate change in the Caribbean.</p> <p>It is the official repository and clearing house for regional climate change data, providing climate change-related policy advice and guidelines to the Caribbean Community (CARICOM) Member States through the CARICOM Secretariat. In this role, the Centre is recognised by the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Environment Programme (UNEP), and other international agencies as the focal point for climate change issues in the Caribbean. It has also been recognised by the United Nations Institute for Training and Research (UNITAR) as a Centre of Excellence, one of an elite few.</p>	Regional (CARICOM, United Kingdom Overseas Territories, Cuba)

5. Legislative and policy framework to address climate change

There are approximately 20 main pieces of legislation (Section B, 12) in Barbados, which deal with environmental, land use and building issues. Of these 37 statutes, 62% may be classified as environmental, 27% as related to land use and 1% as related to building. The most practical criterion for classifying these acts is to determine the predominant purpose and subject matter addressed by the legislation. However, given the linkages between environmental, land use and building issues, there is some overlap among the various statutes.

(a) Barbados National Physical Development Plan

Under the Town and Country Planning Act, development has a wide scope including building, mining, engineering and other operations, in, on, over, or under any land; the making of material change in the use of buildings or other land or the subdivision of land. Development also extends to the sea bed within the 12 nautical mile territorial sea of the island. The Development Order (1972) allows for certain classes of permitted development that do not require formal planning permission.

The act provides for a variety of enforcement actions including the serving of enforcement notices, stop notices and penalties (including fines and imprisonment).

Further, there has been support at the policy level for exploring renewable energy generation. The Barbados National Physical Development Plan, amended in 2003, includes a revised land use map on which suitable sites have been earmarked for wind energy development. The supporting policy statement is captured in the following excerpts:¹⁹

Section 1.5.2 National Infrastructure

1.5.2.4 Wind Energy Development

The Government is committed to the development of renewable energy resources. Approximately 20%²⁰ of the Island's energy needs are currently served by renewable energy sources. The most recent National Strategic Plan establishes the target that 40% of the Island's energy needs will be met by renewable sources by 2010.

Wind energy is a renewable energy source with significant potential. It is estimated that up to 10% of the Island's energy needs can be served by wind energy. Wind energy development will help to reduce reliance on fossil fuels and imported oil. There are a limited number of sites in Barbados that are suitable for wind energy development. These sites should be protected. (Pages 1-19).

Section 5.7 Wind Energy Development

5.7.1 Introduction

Other than the wind resource itself, the suitability of a site for wind energy development depends on a number of factors. The size of the site, its distance from residential users, its proximity to the electrical grid, road access and the ability of the soil to support foundations, are important determining elements.

There are a limited number of sites in Barbados that meet these criteria. These include the following: Lamberts, St. Lucy; Lamberts East, St. Lucy; Upper Salmons, St. Lucy; and Bissex Hill/Melvin Hill, St. Joseph.

Policies:

¹⁹ The Barbados Physical Development Plan, 2003.

²⁰ More recent documentation suggests that 15% of the island's energy needs are met by renewable sources.

5.7.2.1 Existing wind energy sites and facilities shall be protected from sensitive and incompatible land uses and developments.

5.7.2.2 Potential wind energy sites shall be protected for wind energy development.

5.7.2.3 All proposals for wind energy development projects will be subject to a Wind Energy Assessment and an Environmental Impact Assessment approved by the Chief Town Planner” (pages 5-18, 5-19).

Three major national structures are in place to effect sustainable development including:²¹

- The National Commission on Sustainable Development
- National Strategic Planning
- The Environmental Management and Land Use Planning for Sustainable Development Project.

(b) The National Sustainable Development Policy

The National Sustainable Development Policy was finalised in 2002 and was laid in Parliament in October 2003. It is hoped that the policy will be used by decision makers and citizens alike to adapt current attitudes and behaviours to reflect the principles of sustainability.

The overarching goal of this policy is “to ensure the optimisation of the quality of life for every person by ensuring that economic growth and development does not occur to the detriment of our ecological capital”. The major objectives are:

- To formulate a national definition of sustainable development
- To provide a national framework for decision-making based on our principles of sustainable development
- To promote the principles of sustainable development and encourage all persons to adopt and apply these principles in every aspect of decision-making
- To sensitise and educate all persons in Barbados about key issues and conflicts between development and environment, and the need to make wise consumption and production choices.

In response to Barbados’ commitment to sustainable development, the National Commission on Sustainable Development was established in 1997, with a mandate to formulate a National Sustainable Development Policy. The overarching goal of the Policy is “to ensure optimisation of the quality of life for every person by ensuring that economic growth and development does not occur to the detriment of our ecological environment”.²²

The sustainable energy policy aims to assist the country in fulfilling its obligations under the UNFCCC. As such, this policy includes recommendations to:

- Determine and implement appropriate economic instruments and other relevant legislation to promote energy conservation and renewable alternatives
- Articulate energy efficient standards

²¹ The Barbados National Assessment Report on the Implementation of the Barbados Programme of Action, 2003.

²² The Barbados National Commission on Sustainable Development, 2004.

- Promote research and development
- Cooperate with regional and international initiatives aimed at enhancing the use of renewable energy sources and more efficient technology.

(c) The Environmental Management and Land Use Planning for Sustainable Development Project (1997-1998)

The EMLUP study provided a policy framework conducive to long-term economic growth and development. The policy framework was envisaged to strengthen the ability of the country to implement national policy priorities for natural resource management and update national land use policy and planning to improve its responsiveness to future physical and economic development.

The major outputs of the EMLUP²³ study designed to integrate social, economic and environmental policies include:

- A draft comprehensive Environmental Management Act: The draft act provides regulations for a variety of environmental and developmental themes, including freshwater resource management, solid waste management, coastal zone protection, to name a few
- An Environmental and Natural Resources Management Plan: This draft plan makes provisions for the technical evaluation, regulation, and monitoring of all development projects. The Environmental Management Plan incorporates management actions for improvement of the environment
- Proposed Institutional Framework for Environmental Management: In the initial stages of developing the Environmental Management Plan, it was recognised that specific departments had to be empowered to execute certain functions. In order to achieve this, specific institutional structures were recommended for various environmental agencies
- National Environmental Impact Assessment (EIA) Guidelines and Procedures
- National Park and Development Plan: Under EMLUP, certain areas identified as national parks and would be protected. Once the proposed institutional restructuring occurs, a Natural Heritage Department, within the Ministry of Housing, Lands and the Environment is to be established. This department will have jurisdiction over the establishment of the National Park site, and monitoring of various types of activities that can take place in these areas
- A revised national Physical Development Plan (PDP): This revised PDP attempts to encapsulate the principles of sustainable development to guide land resource management. This was achieved through an EIA of the revised PDP. National review hearings have been completed and the findings sent to Cabinet. Amendments made by Cabinet now await incorporation into the revised Plan. While incorporation is outstanding, the principles in the revised Plan are currently being used to guide physical development planning.

(d) Coastal Zone Management Act (CZMA)

The coastal zone or coastal area of Barbados is defined within the CZMA, as all those areas in which coastal resources are located. Coastal resources in turn are defined as, “the land, water and living resources associated with the shoreline marine areas of Barbados, including beaches, shore cliffs, coral reefs, coral rubble, algal beds, sea grass beds, sand dunes, wetlands and other ecosystems found along the shore together with the flora and fauna found in these areas”. Despite the apparently narrow geographical

²³ <http://www.eclac.org/dmaah/noticias/paginas/9/15479/Barbados.pdf>

area inferred by this definition, the CZMA coastal management area is in actuality a much wider geographic area, as ordered by the Minister of the Environment.

(e) The Town and Country Planning Act

The Act provides the legal framework for the physical land use planning system. However, this land use planning system emerged in the 1950s when the island's economy was moving away from the sugar monoculture to tourism, industry and services, and so does not take environmental or climate change issues into consideration. This act provides for three key management functions:

- A national PDP system
- A development control system
- An enforcement system.

6. Key sectors

The sectors and systems identified as most vulnerable are listed below.

- Tourism
- Transportation
- Water resources and drainage
- Human settlement and infrastructure
- Information and policymaking.

“Water”, “Energy” and the “Built Environment” are regarded as cross-cutting themes.

7. Overview of research and studies on climate change

(a) CPACC Project

Through the implementation of the CPACC project, Barbados benefited:

- Coastal Vulnerability and Risk Assessment: Under Component 6 of the CPACC project (that is, Coastal Vulnerability and Risk Assessment Pilot) an initial assessment for Barbados was carried out
- Under Component 1, a Sea Level/Climate Monitoring Network (Regional) was designed for the 12 participating CPACC countries, and provided a standardised set of instruments to measure water levels, vertical land motion, air and sea temperature, and velocity, precipitation and other site specific variables
- Establishment of a framework for a Coastal Resource Information System (CRIS)
- Articulation of a National Climate Change Issues Paper which explores the projected climate change impacts on Barbados, and feasible adaptation options to address them²⁴
- National Climate Change Policy and Implementation Plan: a draft integrated management and planning framework for cost-effective response and adaptation planning and

²⁴ Expert judgment, in accordance with IPCC regional projections, was used to complete this document, as no downscaled scenarios were available for Barbados at that time.

management. This includes the identification of policy options and instruments that may help initiate the implementation of a long-term programme of adaptation to climate change

- Enhancement of capacity in the institutions collaborating with the project.

(b) ACCC Project

Through the implementation of the ACCC project, Barbados benefited from:

- Development and distribution of risk management guidelines for climate change adaptation decision making and political endorsement (by CARICOM) of the business plan and establishment of the basis of financial self-sustainability for the CCCCC
- Development of a guide to assist EIA practitioners in CARICOM countries to integrate climate change in the EIA process
- A draft regional public education and outreach (PEO) strategy
- Development and handover to MACC of the CCCCC website
- Successful launch of a Master's Programme in climate change (the first set of graduates, in 2003, included eight students)
- Statistically downscaled climate scenarios development for Jamaica, Trinidad and Tobago, and Barbados
- Staff training and development at the Caribbean Institute for Meteorology and Hydrology (CIMH) in climate trend analysis in order to strengthen climate change capacity.

(c) Climate Change and Health Project

Barbados is participating in the global project on climate and health being executed through a collaborative arrangement between the WHO and the UNDP with funding support from the Global Environment Facility (GEF). The Ministry of Health is the lead agency for the national component of the project and has the support of the Ministry of Environment. Given Barbados' strong dependence on ground water for potable water, the Ministry of Health has chosen to focus its activities on "Water Scarcity and Quality".

(d) Second National Communications

Barbados has received funding support from the GEF (through UNDP) to undertake its Second National Communication to the UNFCCC. The project will be executed over the next two-three years. The Second National Communications will include:

- An inventory of greenhouse gases
- Programmes containing measures to facilitate adequate adaptation and mitigation to climate change
- An analysis of measures for greenhouse gas abatement
- Information related to the implementation of the UNFCCC.

(e) MACC Project

This project commenced in 2004 and was completed in December 2008. The project's main objective was to mainstream climate change adaptation strategies into the sustainable development agendas of the small-island and low-lying States of CARICOM. MACC adopted a learning-by-doing

approach to capacity building, consolidated the achievements of CPACC and ACCC, continued to strengthen institutional capacity and the knowledge base, and deepened awareness and participation. Project components include:

- Building capacity to identify climate change risks, including among other things, the strengthening of networks to monitor impacts on regional climate, downscaling global climate models, and developing climate impact scenarios
- Building capacity to reduce vulnerability to climate change
- Building capacity to effectively access and utilise resources to minimise the costs of climate change
- Public education and outreach.

The project's outputs will be monitored and evaluated to contribute to the long-term sustainability of project activities and objectives. Outputs from which Barbados benefited include:

- The mainstreaming of adaptation to climate change into national and sectoral planning and policies through the use of climate models, developed and customised through the project
- The creation of an environment conducive to the implementation of measures for adaptation to climate change.

Additionally, consultations and project outputs have informed the development of a Regional Climate Change Adaptation Strategy, which is currently being circulated for comment.

8. Other initiatives relevant to climate change

(a) Solar Expansion Project

GEF, through UNDP, will be implementing a Solar Expansion Project in Barbados to diversify power generation through the integration of renewable energy sources, thereby reducing GHG emissions and contributing to climate change mitigation. Project activities will include:

- Inventory and selection of suitable building types
- Assessment of infrastructural requirements including monitoring equipment
- Installation of Photovoltaic (PV) systems at pilot sites
- Publicising results of pilot study
- Definition of a framework for integrating independent power production into the national grid.

(b) Green economy

The government is seeking to increase energy efficiency by promoting energy-efficient technologies and usage. The government has recently turned its attention to energy conservation and efficiency in sectors of the economy to promote its vision of "Green Economics". Initiatives in these sectors will include incentives to:

- Manage/minimise solid waste, promote recycling and separation
- Promote "green" building techniques and standards
- Use alternative fuels/ renewable energy (tax incentives)

- Purchase “green” products, i.e. solar pumps, solar lights, composters; water storage/ saving devices
- Energy conservation in the public sector.

The Government is also committed to:

- Implementing economic incentives to promote energy conservation; efficient energy use; renewable energy sources
- Introducing standards for efficient energy use in technologies
- Encouraging the large-scale generation of energy using renewable sources
- Promoting research and development into renewable energy
- Implementing disaster management initiatives to mitigate against climate change.

(c) Wind Farm

The Barbados Light and Power Company (BLPC) Limited intends to complement its energy mix to include wind, by erecting several wind turbines to produce about 10MW of electricity. A feasibility study was carried out to build a wind farm in the north of the island. The BLPC Ltd. projects that the facility could generate as much as 26 million KWh annually. Given the current price of fuel imports, the facility could save US\$4.6 million a year. A Fuel Cane Power Generation feasibility assessment was also carried out. A 30 MW plant could generate 263 million KWh and reduce the fuel import bill by US\$29 million per year.

(d) Millennium Development Goals

The Millennium Development Goals are the world’s time-bound and quantified targets for addressing extreme poverty in its many dimensions (income, poverty, hunger, disease, lack of adequate shelter, and exclusion) while promoting gender equality, education, and environmental sustainability. They address the basic human rights of individuals, described as the right of each person on the planet to health, education, shelter, and security. The internationally–agreed framework of 8 goals and 18 targets was complemented by 48 technical indicators to measure progress in achievement of the Goals.

Barbados is expected to meet all of the Goals and exceed some of them, as many national programmes already support activities towards making progress in their achievement. The 2005 report on progress of the Millennium Development Goals revealed that of the 22 countries in Latin America and the Caribbean, Barbados is the only country to have achieved Goal #2 of “Education for All”.

Whilst extreme poverty is not present in Barbados, the country is well on its way to achieving Goal 1, to “Eradicate extreme poverty and hunger”. Of relevance to this assessment are Barbados’ efforts to achieve Goal 7: “Ensure Environmental Sustainability” and more specifically, Target 9 (“Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources”). The indicators for assessing this target are:

- Proportion of land area covered by forest
- Ratio of area protected to maintain biological diversity to surface area
- Energy use (kg oil equivalent) per US\$1 GDP
- Carbon dioxide emissions per capita and consumption of ozone-depleting Chlorofluorocarbons (CFCs)

- Proportion of population using solid fuels.

With respect to Target 9, critical strategies have been identified in the areas of integration, resources management and public education and awareness. For example, the Environment Division through its new policy, regulatory and development functions has identified strategies and resource requirements necessary to address environmental sustainability issues within the national framework for growth and development. In addition, government has committed resources to a number of agencies for environmental management. Government's approximate "green" budget for 2005-2006 is BD\$318 million and comprises programmes and projects within selected ministries associated with environmental sustainability.

(e) The proposed Renewable Energy Centre

This has been planned for Barbados, although no date for its operation has been identified.

(f) Certification programme

This programme targets companies that manufacture solar water heaters from the Florida Solar Energy Centre.

(g) Ongoing public education programmes

These education programmes encourage the most efficient use of electricity and generally improvement of national awareness about climate change issues.

(h) Public Sector Energy Policy

This policy is an operational guide for the efficient use of energy at public sector installations and amongst its vehicular fleet.

(i) Climate change adaptation strategies

Climate change adaptation strategies are being executed through the ongoing work of the Coastal Zone Management Unit, where efforts are primarily concerned with the proper management and use of resources resident in the coastal area of Barbados.

(j) Proposed Sugar-Cane Industry Restructuring Project

This project is seeking to produce ethanol and use bagasse as fuel. Investigations are currently underway to advance this as a CDM Project.

(k) Waste reduction initiatives

Under the portfolio of the Sewerage and Solid Waste Project unit of the Ministry of Health, there is a proposal under negotiation to execute a Landfill Gas to Energy project, which is also being considered for the CDM.

9. Relevant data on Barbados

(a) Meteorological and climatological data

A Global Positioning System (GPS) has also been installed and calibrated at the CZMU headquarters. As a participant in the Global Level of Sea Surface programme which coordinates global monitoring of the sea surface, the GPS data is submitted to the United States National Oceanic and Atmospheric Association (NOAA) for processing.

The Barbados Meteorological Services' mission is to observe and understand the weather and climate of Barbados and the region, and provide meteorological, hydrological and marine services in support of the national needs and international obligations.²⁵

The Coastal Zone Management Unit collects data on:

- Beach profiling at approximately 80 sites
- Wave climate analysis
- Tide level monitoring
- Water quality assessment
- Fringing and bank reef surveys.

(b) Comprehensive socio-economic data

- United Nations statistical website (<http://unstats.un.org/unsd/default.htm>)
- The Barbados Statistical Services (<http://www.barstats.gov.bb/>) has a mandate to collect, compile, analyse, abstract and publish reliable and timely information relating to the social, economic and general activities or conditions of the inhabitants of Barbados. The department falls under the Division of Economic Affairs and Development, Ministry of Finance and Economic Affairs and Development.
- Central Bank of Barbados. (www.centralbank.org.bb).

10. Needs and gaps

- Broader network of monitoring stations for example, tide gauges, wave recorder in Carlisle Bay
- Supportive technologies to decrease the country's reliance on imported fossil fuels and the legislation to facilitate them
- Increased costs due to large capital investments in technology and infrastructure and ongoing maintenance.

11. Conclusion and recommendations

There is a high level of public awareness in Barbados of climate change and the issues associated with it. This is evident from the large number of initiatives that are completed, under execution or planned. The extensive legislation that addresses sustainable development and environment, while not climate change specific, would suffice (to a large degree) as a response to climate change, if enforced. However, not all are adequately enforced, and this is likely due to:

²⁵ http://agriculture.gov.bb/default.asp?V_DOC_ID=1150

- Limited human resources with the relevant capacities
- Overlap and duplication of the functions of some institutions for monitoring and control
- Lack of a comprehensive (umbrella) environmental management act
- Lack of comprehensive regulations (environmental standards, guidelines) that support the legislation
- Lack of anticipatory planning relating to the management and maintenance of drains, culverts, gullies and other water courses, private wells.

However, in order to better deal with climate change impacts such as coastal erosion, flooding and salt water intrusion, it will be necessary to amend current legislation by:

- Strengthening the content of legislation and the promoting of effective enforcement measures
- Increasing penalties so that legislation is in fact a deterrent to non-sustainable behaviour.

Although Barbados has employed, in some areas, renewable and more efficient technologies, the comparatively low costs and easy access of fossil fuels make the former less attractive. Given that natural gas is the cleanest form of energy; its availability makes it very difficult to argue for renewable alternatives, particularly, in view of the competitive price for this source of fuel, and the fact that in many cases the initial capital investment in alternative technologies is prohibitive to developing countries like Barbados. With national supplies expected to run out in the next 5 to 15 years, Government has turned its attention to its oil-rich neighbour, Trinidad and Tobago, as a source of natural gas.

Table 5
List of participants at the consultations in Barbados.

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12. Barbados' legislation related to sustainable development, with implications for responding to climate change

A number of policy documents are used to promote the sustainable development and the mainstreaming of environmental concerns into aspects of national planning. These include:

- The Soil Conservation Programmes, 1957
- Barbados Storm Water Drainage Study, 1996
- Draft Policy Framework for Water Resources Development and Management in Barbados, 1997
- Water Resources Management and Water Loss Studies, 1997
- Emergency Drought Management Plan, 1998
- Barbados Poverty Assessment Report, 1998
- The National Park Study, 1998
- The Coastal Zone Management Plan, 1998
- Environmental Management & Land Use Planning for Sustainable Development – Environmental and Natural Resources Management Plan, 1998
- Agriculture Area Development Plan, 1999
- State of the Environment Report, 2000
- Barbados National Report to the World Summit on Sustainable Development (Rio + 10), 2001
- Green Paper on the Sustainable Development of Tourism in Barbados: A Policy Framework, 2001
- First National Communications to the UNFCCC, 2001
- The Barbados Sustainable Development Policy, 2004
- Barbados National Physical Development Plan, 2006
- The National Strategic Plan, 2006
- National Biodiversity Strategy and Action Plan, 2006
- Gully Ecosystem Management Study, 2006
- Medium Term Strategic Framework for the Agricultural Sector: 2006, 2007-2009.

DOMINICAN REPUBLIC



Source: <http://www.worldtravelguide.net/country/77/map/Caribbean/Dominican-Republic.html>

C. DOMINICAN REPUBLIC

1. Introduction and brief summary of the discussions

Consultations were held with several stakeholders during the period 23-24 October 2008. These informal consultations took the form of focus group meetings or dialogue with individuals.

Some persons indicated that a similar scoping exercise had been recently conducted by the World Bank but, so far, no activity has ensued. However, the economics of climate change project was regarded as a much needed opportunity to understand the issues and implications of not taking action against climate change. It was hoped that the economics of climate change study would receive the same acceptance as the Stern Report did in the United Kingdom, particularly amongst economists, planners and policymakers. There is strong government support for climate change initiatives in this country and many policymakers are easily accessible to the technicians carrying out the studies. This support is not as extensive as it needs to be, however. Climate change should be regarded as a cross-cutting issue in national development planning.

The National Meteorological Office of the Dominican Republic has been working with the Meteorological Institute (INSMET) in Cuba for 30 years on analyzing climatic phenomena, particularly droughts. Studies have concluded that the extent, severity and intensity of these events have increased over this time period. There are extensive time series climate data, and the majority has been digitised in collaboration with the NOAA. Consequently, no further climate data are needed in order to carry out climate change analyses.

In the early part of 2008, the Light Bulb Substitution Programme was launched. It sought to replace 10 million incandescent light bulbs with energy-saving compact fluorescents (CFLs) in 840,000 Dominican homes. Three million of the CFLs of the 18-watt variety (equivalent to 75-watt incandescent bulbs) were given out in the *barrios* that received subsidised power under the Reduced Blackout Programme. The remaining 7 million bulbs of the 14-watt variety (equivalent to 60-watt incandescent bulbs) were given out in the programme sectors.

As is the case in many countries, enforcing legislation is challenging, however education and incentives are likely to bring about desired changes. The Dominican Republic is part of the Group of Latin America and Caribbean Countries (GRULAC) negotiating group and has the following position with regard to the Kyoto Protocol: (a) that adaptation should be the main objective of Latin American and Caribbean countries, even though mitigation was the focal point of discussions; (b) that the largest emitters should contribute the most for adaptation measures in vulnerable states; (c) and these larger emitters should also be “forced” to have effective reductions.

The Dominican Environmental Consortium is a non-profit organisation, which was established to coordinate the actions of the organisations involved in environmental projects, with the aim of becoming a center of excellence and influencing in decisions in the areas of environmental and natural resources of the country. A dozen institutions in the environmental sector that currently comprise the consortium include the: Loma Quita Spur Foundation Center for Sustainable Agriculture with Appropriate Technology, National Botanical Garden, Jaragua Group, Progressio Foundation, Center for Conservation and Eco-development of Samana Bay and its environment, Secretary of State for Environment and Natural Resources, Ecomar Programme, German Technical Cooperation Service Social Council, Swiss Association for International Cooperation Helvetas and the Institute of Development Economics Association. The Dominican Environmental Consortium has recently been working on incorporating environmental issues into the Constitution of the Dominican Republic, which is currently being revised.

In terms of current natural disasters or hazards, the Dominican Republic was badly affected by Hurricanes Ike and Gustav, and Tropical Storm Fay in 2008.

2. Country overview

The Dominican Republic is located between parallels 17° 36' and 19° 58' north latitude, and 68° 17' and 72° 00' west longitude. This places the country on the edge of the north tropical zone. It shares the island of Hispaniola with Haiti, occupying the eastern two thirds of the island. The main coastal marine ecosystems in the Dominican Republic occupy 66,160 hectares, of which 8,940 hectares are mangroves, 18,600 are marine grasslands, 13,300 are coral reefs, and 24,420 are beaches. The variable climate is due to the country's latitude, insularity, proximity to large bodies of water and land masses, temperature of the neighbouring seas, dominant Northeast trade winds, pressure systems, island terrain and hurricanes. The equatorial currents from the North and South affect the country due to their high temperatures and water content, contributing to the intensification of these characteristics of the climate.

The Dominican Republic represents the largest economy in the Central American and Caribbean region. It is a lower, middle-income developing country, primarily dependent on natural resources and government services. Although the service sector has recently overtaken agriculture as the leading employer of Dominicans, agriculture remains the most important sector in terms of domestic consumption and is second to mining, in terms of export earnings. Free Trade Zone earnings and tourism are the fastest-growing export sectors that contribute significantly to the service industry of the country.

According to the 2005 Annual Report of the United Nations Subcommittee on Human Development in the Dominican Republic, the country is ranked No.71 in the world for resource availability, No.79 for human development, and No.14 in the world for resource mismanagement. These statistics emphasize national government corruption, foreign economic interference in the country, and the gap between the rich and poor. Bajos de Haina, which is located 12 miles (19 km) west of Santo Domingo, was included on the Blacksmith Institute's 2006 list of the world's ten most polluted places. This was due to lead poisoning caused by a battery recycling smelter which was closed in 1999. As the site was never restored, children continue to be born with high levels of lead, resulting in learning disabilities, impaired physical growth and kidney damage.

For more than 40 years, electrical services in the country have been challenging for the population, the business sector as well as other areas. No administration has been able to cope with this problem. In 1998, three regional electricity distribution systems were privatized via the sale of half the shares to foreign operators. In late 2003, the Mejía administration made an unexpected decision to repurchase all foreign-owned shares in two of these systems. The third, which serves the eastern provinces, is operated by United States concerns and is also 50% United States-owned. Industry experts estimated distribution losses of 40% for 2006, which was due primarily to low collection rates, theft, and corruption. At the close of 2006, the government had exceeded its budget for electricity subsidies. Still, in 2007 some areas have outages lasting as long as 20 hours a day. Tourist areas tend to have more reliable power, as do business, travel, healthcare, and vital infrastructure. The electricity sector is highly politicized, and with the 2008 presidential election campaigns already in motion, the prospect of further effective reforms of the sector is poor.

3. Overview of the Dominican Republic's participation in the international and regional climate change responses

The Dominican Republic ratified the UNFCCC in October of 1998 and the Kyoto Protocol in February 2002. The country has thereby assumed the commitments in accordance with Article 12 of this

Convention, including the submission of its Initial National Communications in 2003. The second national communication will be completed within the first quarter of 2009.

The Dominican Republic has proposed a number of CDM Projects to the UNFCCC, including the El Guanillo wind farm and the Bionersis project on La Duquesa landfill.

4. Institutional framework to address climate change

(a) Commission on Climate Change

This inter-sectoral body was established by Presidential decree in early October 2008, in response to the government's concern that there was limited awareness and action amongst policymakers in all sectors on the topic of climate change.

(b) The Ministry of Environment and Natural Resources

The administration of the environment, ecosystems, natural resources and climate change is placed under the responsibility of the Ministry of Environment and Natural Resources, by Law 64-00. Its main tasks are to draft, execute and supervise the application of national policies on the environment and natural resources. The Ministry is also responsible for ensuring: (a) the preservation, protection and sustained use of natural resources; (b) the improvement of soil, air and water contamination rules; (c) the proper exploration and exploitation of mineral resources; (d) the preservation of coastal and sea resources; (e) and the establishment of general environmental rules for human settings and industries.

Existing environment-related institutions and/or attributions, such as the Natural Resources Office of the Ministry of Agriculture and the Earth Crust Protection Office of the Ministry of Public Works, have been transferred to the Ministry of Environment and Natural Resources. In this manner, environmental aspects of all economic or human activities will be controlled by the Ministry. It will grant authorisations, supervision and recommendations or consultations, in co-operation with other government, municipal and civil authorities and institutions, to ensure the comprehensive protection of natural resources in the country.

In addition, the National Council of Environment and Natural Resources will be formed of State and civil society members. This council will be responsible for programming and evaluating environmental policies, and establishing the national strategy of biodiversity preservation.

5. Legislative and policy framework to address climate change

There is no specific climate change legislation in the Dominican Republic, however, much of the country's environmental legislation is relevant to climate change.

(a) Renewable Energy Legislation

President Fernández recently signed the Incentive for Renewable Energy Bill. This new law provides tax and duties incentives on alternative energy imports and facilities research and the application of renewable energy technologies. Law 57-07 eliminates former law 2071, thereby opening the Dominican Republic to the development of alternate energy sources. Under the regulation of the National Energy Commission, this new law has the following incentives:

- A 100% exemption over import duties for equipment, machinery and accessories required for renewable energy production

- 100% exemption over sales tax for all previously mentioned equipment
- A 100% 10 year exemption over income tax for companies or individuals. These benefits would extend to 2020
- A reduction to a fixed 5% on the tax over foreign-financed interest payments, modifying Article 306 of the Dominican Tax Code for the beneficiaries of this new law
- Up to a 75% credit on capital cost of equipment required by owners or renters of family homes and commercial or industrial establishments who shift entirely to renewable energy systems or increase their energy consumption share in these. This tax credit will be deferred to the consumer's income tax for the next three years, discounted at a proportion of 33.33% per year.

This new bill also calls for the creation of a CO₂ emissions bond market under the platform of the Kyoto Protocol, which will be regulated by the Ministry of Environment and Natural Resources as part of the Clean Development Mechanism.

(b) Environmental Law

The legal framework that provided for environmental protection in the Dominican Republic before 2000 was comprised of several special laws, presidential decrees, resolutions and administrative measures, which were often contradictory and lacked a scientific character. As a result, natural resources were not effectively protected in the country, although they were comprehensively regulated.

After the signature and ratification of several international agreements, such as the Vienna Convention (Ozone Layer Protection), the Rio Agreement (Biological Diversity) and others, it was recognized that one of the main challenges facing the Dominican Republic was the modernisation of its policies and laws on environmental protection. In response, a bill for a general law on the environment and natural resources was submitted to Congress for approval in October 1999, and was passed as Law 64-00 in August 2000. Special laws in other areas such as tourism, electricity and telecommunications, also pay particular attention to environmental concerns.

Law 64-00 recognises the importance of the protection, preservation and sustained use of natural resources for the well-being of humanity. It underlines the need for protection of the unique, yet fragile, threatened and deteriorated natural resources of the country. This environmental law also outlines urgent measures needed to arrest deforestation and dry conditions currently prevailing throughout the national territory, and seeks to prevent, control and repair the degradation of the environment.

Under Law 64-00 the effective protection of the environment is placed as an essential duty of the State, which must adopt an integral policy to be executed with the participation of all institutions related to natural resources. This is a means of concentrating all scattered efforts and ensuring their effectiveness.

The responsibility for protecting and restoring the environment is shared amongst the State, society in general and each individual in particular. In this manner, the law provides for the mandatory inclusion of environmental programmes in all social and economic development programmes.

The main objective of Law 64-00 is "to provide rules for the protection, improvement and restoration of the environment and natural resources, by ensuring the sustained development thereof". Furthermore, the law recognises the principle of precaution by providing that "lack of scientific absolute certainty shall not be called as a reason not to adopt preventive effective measures in any activity having a negative influence on the environment".

Law 64-00 regulates soil, water and air contamination; dangerous products, elements and substances; domestic and municipal waste; human settlements; and noise pollution. It also regulates the granting of rights by the Ministry of Environment and Natural Resources and/or municipal authorities for the use of natural resources, such as soil, water, coastal and sea resources, forests, caves and mineral resources.

(c) Forest Law

In December 1999, the Dominican Republic enacted a new forest law (Law 118-99). Article 95, Paragraph I of the law allows the National Forestry Resources Institute (INARF) to adopt regulations that create special incentives to promote the valuation of the environmental services of forests, including carbon fixation. The State will issue negotiable reimbursement certificates to finance 80% of the expenses of capital and investments made in such activity. This funding will also apply to the handling of plantations and management and protection of forests. The expenses include payment of all the existing taxes.

A National Adaptation Strategy for climate change is being developed at this time.

6. Key sectors

Key sectors in the Dominican Republic that relate to climate change include:

- Agriculture
- Energy
- Tourism
- Manufacturing.

7. Overview of research and studies on climate change

(a) Initial National Communications

In compliance with the programme of the UNFCCC, the Dominican Republic conducted a national study of vulnerability and adaptation to climate change in the areas of water resources, coastal zones, agriculture, forestry, and health. The study was developed with the creation of climatic scenarios, based on general circulation models and on the Model for the Assessment of Greenhouse-gas Induced Climate Change and Regional Climate Scenario Generator software, which were adapted to the climatic data of the country and applied to the above-mentioned sectors. Summaries of these studies can be found in the Initial National Communications for the Dominican Republic (2003).²⁶

(b) Expanding Access to Modern Energy Services – Replicating, scaling up and mainstreaming at the local level (2006)²⁷

This report provides an assessment of how projects on access to energy services can be scaled up, replicated and mainstreamed to help meet the Millennium Development Goals. It starts from the basic premise that the need for improvement arises from the limited impact and sustainability, inherent in small-scale or, “one-off” energy projects. It is acknowledged that there are several community-level

²⁶ <http://unfccc.int/resource/docs/natc/domrepnc1.pdf>

²⁷ http://www.undp.org/sgp/download/Expanding_Access_to_Modern_Energy_Services_-_Replicating,_Scaling_Up_and_Mainstreaming_at_the_local_level.pdf

energy initiatives in many countries that are successfully contributing to providing energy services at local levels. If these projects are replicated, mainstreamed and scaled up at the national level, the impacts could have a far reaching positive contribution towards achieving the Goals. The report features three case studies of the GEF Small Grants Programme (SGP) projects in Nepal, the Dominican Republic and Kenya.

(c) Global Climate Change and the Dominican Republic (2006)

This paper provides an overview of how human activities are changing atmospheric composition, how these activities have the potential to, and are changing the climate, and how continuing reliance on coal, oil, and natural gas is projected to alter the climate during the twenty-first century.

(d) Climate Change and Agriculture

This study focuses on drought conditions and their impacts on agriculture. It has been conducted in conjunction with Cuba's Institute of Meteorology (INSMET).

(e) Agricultural and Meteorological Drought: A Scientific Study

Various institutions, such as INSMET and the Dominican Republic's National Meteorological Office, have been monitoring and recording meteorological data in these countries for many years. This study created meteorological and agricultural drought maps of both Cuba and the Dominican Republic, from which strategic planners can make essential decisions regarding drought preparedness and climate change adaptation.

(f) Framework Project for Present and Future Drought Adaptation Policies in the Dominican Republic and the Republic of Cuba

These studies examined Cuba and the Dominican Republic to identify the nature of drought events, assess their adverse effects and document how residents of drought-affected regions are adapting to their changing environment. In addition to identifying and documenting the existing situation, the studies offer improved tools to apply drought warning protocols. Moreover, through the robust usage of scenario planning methodology, they offer a host of policy recommendations.

(g) Precipitation Studies

These studies undertaken by Dominican Republic's National Meteorological Office have concluded that between 1930 and 2008, average rainfall in the country has decreased. This has correlated with an increase in average atmospheric temperature.

Other research and studies conducted in the area of climate change include:

- Coastal impacts of climate change by The Nature Conservancy
- Climate change and health
- Climate change and tourism adaptation study
- Adaptation strategy for the energy sector

8. Other initiatives relevant to climate change

(a) Partnerships in shaping national policies

The GEF SGP has forged partnerships with local communities, national governments, civil society organisations, the private sector and other development partners, to implement projects that have helped to inform and shape national policies in different sectors. These projects have reduced barriers to the implementation of renewable energy, energy efficiency and environmentally sustainable transport practices.

SGP partners have developed innovative ways of enhancing the role played by energy in improving local livelihoods and benefiting the global environment. The project examples in this short publication include contributions to inform policy at different levels in the Dominican Republic, Kenya, Vietnam, Sri Lanka, Morocco and Ghana.

(b) Capacity development for policymakers to address climate change

The UNDP Environment and Energy Group has launched a groundbreaking project to strengthen the national capacity of developing countries to assess climate change policy options across different sectors and economic activities, which could serve as inputs to their national positions under the UNFCCC.

The 13 participating countries, including the Dominican Republic, will identify up to three key sectors in preparation for a national inter-ministerial workshop on national climate actions and the Bali Action Plan. With support from UNDP and international and regional centres of excellence, countries will then undertake an assessment of investment and financial flows to address climate change – both current and projected – for their key sectors. This assessment will provide a better understanding of the magnitude and intensity of national efforts needed to tackle climate change, as well as provide more accurate estimates of the funds needed to implement mitigation and adaptation actions.

(c) Caribbean Biological Corridor

In 2007, Cuba, Haiti, and the Dominican Republic created the Caribbean Biological Corridor, which aims to manage and protect marine ecosystems, home to hundreds of species in danger of extinction because of climate change, by outlining protected areas. Cuba, the Bahamas and the Dominican Republic have the most protected marine areas of the Caribbean and this needs to be extended to other countries.

9. Relevant data on the Dominican Republic

(a) Climate and meteorological data

The National Meteorological Office (<http://www.onamet.gov.do/>) is the primary repository of climate related data.

(b) Socio-economic data

The National Statistics Office (<http://www.one.gob.do/>) not only has socio-economic data, but environmental data as well.

10. Needs and gaps

- More powerful computers for modeling impacts and forecasting drought conditions (particularly on food security and tropical diseases)
- More technically-trained personnel to develop and run models
- Research on drought-tolerant crops
- Health data

11. Conclusion and recommendations

The Dominican Republic clearly regards climate change as an important and cross-cutting issue. Apart from the increased intensity of hurricanes associated with climate change, drought is a great cause for concern in the Dominican Republic. Significant resources have already been expended to determine what likely impacts will be, but responses need to be better supported, for example:

- Propagation of drought-tolerant crops
- Increasing the storage capacity for rainwater/streams
- Increasing of the efficiency of water management

The Dominican Republic has opportunities for both adaptation and mitigation. The revision of the Constitution to include environmental concerns will go a long way in supporting the necessary response to climate change.

Table 6
List of participants at the consultations in the Dominican Republic

Name	Organization	Phone
Jose Rafael Almonte	State Sub-Secretary of Planning and Development	
Gloria Ceballos	National Meteorology Office	809-788-1122 Ext: 223 / 224
Sixto Inchaustegui	United Nations	809-537-0909
Edgar Matos	Subsecretaria Gestion Ambiental	809-472-0626
Sesar Rodriguez	Consortio Ambiental Dominicano	809-385-0480
Magdalena Lizardo	State Secretary of Economy, Planning and Development	
Eurin Cuevas	Instituto de Abogados para La Protección del Medio Ambiente Inc (INSAPROMA)	809-875-8068

GUYANA



Source: <http://www.worldtravelguide.net/country/111/map/South-America/Guyana.html>

D. GUYANA

1. Introduction and brief summary of the discussions

Consultations were held with several stakeholders on 6 and 7 October 2008. These informal meetings were held with individuals and/or small groups.

Table 7
Schedule of consultations in Guyana

Date	Time	Organisation
6 October 2008	8.00 a.m.	Institute of Applied Sciences and Technology
	10:30 a.m.	National Climate Change Unit
	11:30 a.m.	Ministry of Agriculture
	1:30 p.m.	President's Office
7 October 2008	4.00 p.m.	Demerara Distillers Limited, Corporate member of the Private Sector Commission of Guyana Limited

(a) Consultation with the Institute of Applied Sciences and Technology (IAST)

Initiatives in Guyana, in which IAST is participating or has interest include:

- Clay Road Project: This project utilises an extrusion process to ensure that the clay which is being used for the laying of a road, is uniformly fired and is better compacted. It has introduced the scientific approach to an age-old practice, that would ensure higher levels of efficiency, reproducible quality, and a reduction in the amount of fuel required.
- Asbestos Removal Project: The IAST was involved in a project to remove the asbestos from the University of Guyana, as the government sought to ensure the safety of its staff and students. This project involved the removal of asbestos from several buildings including some on the IAST site. All of the asbestos was disposed of and IAST conducted air quality testing to ensure that the air was free from asbestos fibres.
- Climate Change Impact Assessment on Agriculture: From 14-25 April 2008, top researchers from a wide range of Caribbean countries gathered in Georgetown, for intensive technical training in the assessment of climate change impacts on agricultural sectors. The purpose of this training was to provide decision makers in each country with scientific data to guide development planning at both national and regional levels. In the agricultural sector, this is becoming an increasingly urgent task, as food scarcity and high prices are causing violent social unrest in Haiti and numerous other developing countries.
- Carbon Sequestration Project: During a presentation at "The Leadership Challenge of Climate Change", which convened in September 2007 by the United Nations in New York, President Jagdeo identified the need for a new global agenda to recognise and compensate for the contributions of standing forests. In turn, this project seeks to address climate change through avoided deforestation, carbon sequestration and ecosystem services. Guyana's vast, intact forest resources are a critical asset-base for global climate change mitigation, and extensive portions of Guyana's forests will be maintained in their pristine state. In addition, a forest management approach that is based on conservation, sustainable harvesting and utilisation will be developed.

(b) Consultation with the National Climate Change Unit, Ministry of Agriculture, and the Adviser to the President on Sustainable Development

In 2007, a National Capacity Self Assessment of three international conventions including the UNFCCC, the CBD and the United Nations Convention to Combat Desertification (UNCCD) detailed what has been achieved under their respective obligations. The National Climate Unit was established as a result of this study's recommendations.

Immediate concern was expressed for the rationale of a feasibility study to review the costs associated with climate change. The Stern Report recommends such an analysis, which will prove to be a useful decision-making tool, especially for vulnerable countries.

Guyana participated in two completed CARICOM climate change projects, and is now involved in the MACC project, which is being implemented by the CCCCC. More specifically, the project is developing an adaptation strategy for the agricultural sector in Guyana.

Guyana is now preparing its Second National Communications to the UNFCCC, which will include: (a) an inventory of greenhouse gases from base year 2000; (b) programmes with measures to facilitate adequate adaptation and mitigation measures to climate change; and (c) a collection of important information related to the implementation of the Convention such as technological needs, public awareness and the integration of climate change into local and regional policies. The activities required for the preparation of this document are a continuation of work which began in the first National Communications. These efforts are expected to promote capacity building, enhance public awareness with regard to climate change, and facilitate the higher placement of these issues on the national agenda.

The National Climate Unit held consultations to review the Regional Climate Change Adaptation Policy that was developed by the CCCCC. Discussions and comments indicated that the policy adequately represents the general need for adaptation to climate change in Caribbean SIDS. However, it failed to address mitigation as a response, in addition to the fact that it is very hurricane-centered and gave little attention to agriculture as a highly vulnerable sector to flooding.

Guyana's unique circumstances are that: (a) it has ample potential for mitigation initiatives; (b) agriculture is its main industry and the cultivated lands lie on vulnerable coastal belts; and (c) the country is not in the Atlantic hurricane belt. Furthermore, 67% of GDP was lost due to the impacts of floods in 2005, and the country has not totally recovered.

The Regional Climate Change Adaptation Policy, therefore, needs to be tailored to specific country needs. However, as a "Caribbean" policy document, it should also take into consideration the mitigation potential of some Caribbean countries, like Guyana, and propose a simultaneous approach to both adaptation and mitigation.

Despite the extensive outreach efforts in Guyana on climate change issues, more emphasis is needed, in terms of how individuals and communities can reduce their vulnerabilities. Additionally, the sectors which are reported to be the most vulnerable to adverse climate change impacts include agriculture, health, water, human settlements and coastal infrastructure. While there is interest in carrying out further in-depth studies on the potential sectoral impacts and necessary responses, financial support is lacking.

Guyana's National Climate Change Adaptation Policy and Implementation Plan was passed in 2001, however, there is still a need for supporting legislation. As a result of the floods in 2005 and 2006, the Government re-examined the existing drainage system and made additional investments for

infrastructure adjustments and adaptation to the impacts of climate change. Consequently, legislation on drainage and irrigation have advanced as a major response to climate change effects, particularly sea level rise.

Presently, the government is also investing in several long-term initiatives to better manage, operate and improve flood control structures for the East Coast Conservancy. This will include the implementation of the Conservancy Adaptation Project, which is financed under the GEF. Additionally, negotiations have been held with the Government of Japan and other donor agencies to finance new drainage and irrigation infrastructure within the conservancies and Mahaica/Mahaicony areas. This will reduce the possibility of flooding in riverine communities and also expose approximately 121,405.70 hectares of arable land for agricultural development.

Another initiative being pursued is the construction of additional drainage outlets at Westbury and Golden Fleece which is financed under the European Union Rice Competitive Project. This project will increase the drainage capacity from 3.8 to 7.6 cm per day and restore the Dawa pumping station. Investments are continuing in Regions 3, 4 and 6 with the rehabilitation of canals and drains, as well as the installation of pump stations structures, to improve discharge flows. There is also an integrated water resources management approach that supports the climate change policy, but it does not present a direct response to climate change effects.

Guyana has agreed to invest in other initiatives such as agro-energy. To this end, an agro-energy efficiency policy has been drafted, and it will be included in the revised climate change strategy. This policy will, therefore, guide efforts that encompass partnerships with the private sector, capacity building, environmental standards and sustainability, investment attraction, institutional strengthening, and standards and regulations. The impacts of biofuel/agro-energy production on agriculture and rural development include:

- An increased global demand for agricultural products which will result in the creation of new jobs at every stage of the production process, from harvesting to processing and to distribution
- Social and rural development benefits from increased employment and income generation opportunities, provided by the production of agro-energy crops or by-products and their conversion in local industries
- Increased usage of residues from food crops and improved efficiency and sustainability of land use.

In April 2008, the IDB approved technical cooperation grants totalling US\$925,500 to support Guyana's bio-energy development. The funds will be used by the government to promote the development of its nascent bio-energy sector through policy development, training, feasibility studies and incentives for private investment.

ECLAC also conducted a study to explore biofuel potential in Guyana. This study concluded that from the exhausted molasses of 1 metric tonne of sugar cane, 8.8 litres of ethanol can be produced. Considering a national average production of 3.5 million metric tonnes of sugar cane, 30.8 million litres of ethanol can be produced from molasses, which is almost three times the requirement. National bio-ethanol requirements could be met without expanding the current cultivated area.

(c) Consultation with the Minister of Agriculture and members of the National Climate Change Committee

This meeting revealed that work has commenced at the subsector level to improve the production and efficiency of rice, sugar and fisheries sectors. Unfortunately, climate change has not been considered in these areas.

Over the years, Guyana has experienced increased frequency and intensity of weather events, for example Hurricanes Ivan and Katrina, as well as the intense rainfall that caused massive flooding in 2005. Eco-tourism is growing in the interior areas of Guyana, despite the fact that the “good” infrastructure is on the coast. The minister was concerned that even though these inland sites were unaffected by the flooding in 2005, travel advisories to tourism markets did not specify this and the sub-sector suffered as a result. Due to current and projected climatic changes, the Ministry of Agriculture is conducting research into “disease resistant, high yielding” crops, to flower and produce within the same season. They are also investigating crops that are more resilient to being underwater for extended periods, and rice varieties that do not need as fertile a soil type. Management plans are being developed in the fisheries, forestry and mining sectors to accommodate climate change impacts.

Approximately US\$12.5 million of government resources has been allocated for climate change initiatives in Guyana, especially in the areas of building awareness, facilitating discussions and the involvement of agencies and stakeholders. The country is therefore committed to responding to climate change in a leadership capacity, at both regional and national levels.

The critical linkage between climate change and trade was noted, as Guyana’s ability to trade with the rest of the world is affected by investment in areas such as adaptive measures for infrastructure and the stabilized production capacity in the agriculture industry.

Climate change and rising oil prices also presents Guyana with an opportunity to invest in clean energy and in turn, this would create a new source of income for the country. It was pointed out that the less fertile lands of Guyana are more suitable for fuel cane generation, as opposed to food production.

There are also considerations for developing 100,000 hectares of “second depth” land, about 24.35 – 362.025 kilometres from the coast. This area will be equipped with drainage and physical infrastructure, as the coastal lands are vulnerable to sea level rise and salt water intrusion.

The enforcement of major legislation in Guyana is under control, however, there is a problem with respect to controlling waste management. This is due to cultural practices, which are compounded by a lack of public awareness in this area.

(d) Consultation with the Advisor to the President on Climate Change and Chairman of the National Climate Change Committee

The Advisor agreed that with a coast approximately 1.2 m below sea level, Guyana is uniquely vulnerable to climate change impacts as sea level rise will affect the country’s coastal defences. Coastal protection is therefore necessary to keep out the tidal surges that are sometimes in excess of 2 m, especially during the spring high tide. Inundation of low-lying areas is often caused by breaches of sea defences and erosion of the near-shore area, due to wind changes and the resulting shifts in ocean currents. An alarming 90% of the housing settlement and much of the economic activity resides in this vulnerable coastal belt.

While there is a clear need for adaptive responses, Guyana is also well placed to respond to climate change through mitigation as 75% of its forest cover remains intact. Incentives for the country's standing forests were among the country's major proposals brought forward at the 13th Conference of Parties (COP 13), held as part of the December 2007 United Nations Climate Change Conference in Bali, Indonesia.

Additionally, Guyana has expressed its commitment to take action on climate change through the conservation and sustainable management of its forests. The implementation of these efforts will fall under the country's National Forest Plan. A Code of Practice has also been developed for forest producers based on the principles of Reduced Impact Logging.

Guyana's legislative framework in the forestry sector is being revised and updated with new laws to promote greater efficiency, accountability and good environmental stewardship. Guyana is among those countries with high forest cover and historically lower emissions from deforestation. Future emissions will increase unless forest protection receives adequate Reduction of Emissions from Deforestation and Degradation (REDD) incentive and levels of international support are increased. At the same time Guyana makes a high per capita contribution to global carbon storage through the preservation of a high portion of its forests. Its high forest-cover and lower than average historical deforestation rates, is a result of deliberate policies to promote conservation and strategically manage forest utilisation.²⁸

Guyana is currently working on initiatives with local and international agencies to carry out a carbon stock inventory and assessment. These initiatives are expected to enable Guyana to take advantage of market-based mechanisms such as carbon trading schemes. Guyana has mentioned at international forums that it supports market-based mechanisms to provide positive incentives for forest management and conservation. Guyana views the maintenance of its standing forests as a direct mitigation intervention to reduce carbon emissions as well as an improvement in biodiversity values, ecosystem services, sustainable development, and livelihoods for local communities and indigenous populations.²⁹

Flood-prone communities in Guyana were to have benefited from the GEF Climate Change Fund, through a "learning-by-doing" project to allow communities to take charge and develop their own mechanisms for adapting to climate change. This Conservancy Adaptation Project aims to reduce the vulnerability of catastrophic flooding in the Guyana low-lying coastal area that is currently threatened by sea level rise resulting from global climate change. This project has been developed to guide a comprehensive upgrading programme of the East Demerara Water Conservancy and lowland drainage system, with the goal of increasing discharge capacity and improving water level management. Access to financing has not been easy due to the bureaucratic process and stringent requirements involved.

(e) Consultation with the Director of Human Resources, Demerara Distillers Limited

The private sector generally has an awareness of climate change, particularly after the floods in 2005. Many companies have proactively hired Health and Safety Officers, who are responsible for ensuring compliance with certain standards. Many companies are ISO 9000 certified, however none have attained the ISO14000 certification to date.

The DDL plant has been extended, and even though diesel is the primary source of energy, two thirds of the boilers are fuelled by co-generation from methane. This has translated into savings of GY\$30 million per year.

²⁸ http://www.illegal-logging.info/item_single.php?it_id=2812&it=new

²⁹ http://www.illegal-logging.info/item_single.php?it_id=2812&it=new

It is challenging to recycle many products, particularly polyethylene terephthalate bottles, as there is no collection and refund system available like there is for scrap metal. The Government imposes an environmental levy of GY\$10 per unit of non-returnable metal, plastic, glass or cardboard container of any beverage. This brings in about GY\$100 million per year, which goes into the consolidated fund. Demerara Distillers Ltd. chips the non-returnable plastic and ships it to Barbados to be recycled.

The Private Sector Commission of Guyana Limited is part of the national working group on the Millennium Development Goals. Initiatives involve making the benefits of new technologies, especially information and communications available, and launching a public/private sector partnership Advisory Committee to help protect employees in the workplace through education and training.

The task of mainstreaming environmental sustainability in all spheres of the public and private sectors falls within the purview of the Environmental Protection Agency, which coordinates with various sector agencies. In the last few years, the Agency has been weak in building awareness in the private sector.

2. Country overview

Guyana is a tropical country situated on the north-eastern coast of South America. It is bounded by Suriname on the east, the Atlantic Ocean on the north, Brazil on the south and by Venezuela on the west. It is an English-speaking country, with close ties to other English-speaking Caribbean Islands. The country is a member of the CARICOM, which has its headquarters in Georgetown, the capital city.

Guyana has the following characteristics:

- It is a low-lying State with a vulnerable coastal strip
- 90% of the population resides in the coastal plain where the main urban centres and commercial activities are located
- There are a wide range of geographic areas with coastal, hilly sandy, highland, forested and savannah regions
- There is no current tectonic activity in Guyana and indications are that the Guyana shield (and the coastal strip, in particular) will not be affected by convergence of the South and North American plates
- There is a high level of rainfall variability in the country, and the seasons and climate are determined mainly by this variability
- There are four seasons:
 - First dry season (February to April)
 - First wet season (April to July)
 - Second dry season (July to November)
- Second wet season (November to January)
- The country can be divided into climatic regions ranging from very dry (annual rainfall less than 1788 mm) to extremely wet (annual rainfall greater than 4100 mm).

Agriculture is the major economic activity in Guyana. In 2000, this sector contributed 32% to the country's GDP. This was due to the recovery of sugar output and the expansion of rice, timber and other crop production. The forestry sector was influenced by new governmental policies, which facilitated significant foreign investment. Tourism, in the form of eco-tourism, has been expanding and will be a major contributor to the economy in the future.

Guyana is very dependent on imports of fossil fuels for its energy needs. Fuel and lubricants accounted for 16% of total imports in 1994. Bagasse is used for the co-generation of steam and electricity in the sugar industries. However, there is potential for the substantial use of renewable energy sources such as hydropower, solar, wind and biomass.

3. Overview of Guyana's participation in international and regional climate change responses

Guyana signed the UNFCCC at the United Nations Conference on Environment and Development (UNCED) which was held in Rio de Janeiro in June 1992. The Convention entered into force for Guyana on 17 November 1994. As a Non-Annex 1 and Non-Annex 2 Party to the Convention, Guyana prepared its Initial National Communications under the guidance of Decision 10/CP.2 and Articles 4.1 and 12.1 of the Convention. An Enabling Activity Project, funded by the GEF and implemented by UNDP, also called for the preparation of the Initial National Communications and a National Action Plan to address climate change and its adverse impacts.

In addition, at the regional level, Guyana has participated in several regional projects including the following:

- The CPACC Project: This project was developed to support Caribbean countries in their preparations for coping with the adverse effects of global climate change. Particular focus was placed on strategies relating to sea level rise in coastal and marine areas through vulnerability assessments, adaptation planning and related capacity building. The project was executed in 12 Caribbean CARICOM member countries over the period 1998 to 2001.
- The CARICOM ACCC Project: This follow-up, regional climate change project was implemented from 2001 to 2004. Although Guyana did not participate in any of the two pilot projects implemented under this project, benefits were gained from the processes undertaken and outputs achieved at the regional level.
- The MACC Project: This third Caribbean regional climate change initiative is currently being implemented. Twelve CARICOM member States, including Guyana, are participating. This project commenced in September 2003 and is due for completion in December 2008.

4. Institutional framework to address climate change

The President of Guyana has the mandate for environmental issues including those related to climate change. The Natural Resources and Environment Advisory Committee is composed of heads of relevant agencies. After discussions at this committee level, all climate change matters are presented to the President and/or Cabinet.

The National Climate Unit, with the support of the National Climate Change Committee oversees all activities relating to climate change, ozone depletion and desertification and reports to the Chairman of the NREAC. The chief hydro-meteorological officer chairs the NCC, and its membership includes all agencies which are relevant to climate change issues.

5. Legislative and policy framework to address climate change

(a) Climate Change Adaptation Policy and Implementation Plan

This policy was completed in 2002 and is Guyana's response to the Formulation of a Policy Framework for Integrated Coastal and Marine Management, Component 4, of the CPACC project. However, in order to better reflect the possible impacts climate change on Guyana, this title was changed to the National Climate Change Adaptation Policy and Implementation Plan.

The Initial National Communications and the National Climate Change Adaptation Policy and Implementation Plan are similar in content, in that both are focused on the anticipated negative effects of global climate change. However, the National Climate Change Adaptation Policy and Implementation Plan contains intrinsic differences which supplement the work mentioned in the Initial National Communications. While climate change will negatively impact the entire country, the policy focuses primarily on the low-level coastal plain which is highly vulnerable to sea level rise. Although protected by a system of walls, the coastal plain is particularly susceptible to the effects of climate change as almost 90% of the population resides in this area which is already 6 feet below sea level.

(b) Climate Change Action Plan (2001)

The Action Plan seeks to address the commitments of Guyana to the UNFCCC by “formulating national programmes containing measures to mitigate climate change by addressing anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, and measures to facilitate adequate adaptation to climate change” – Article 4.1 (b).

The plan also seeks to develop, apply and diffuse technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases in all relevant sectors, including energy, transport, industry, agriculture, forestry, waste management and health. However, the government of Guyana has stated that the plan cannot be implemented without financial and other resource assistance of the developed country parties and multilateral institutions. It is therefore necessary that the Convention Secretariat, the Global Environment Facility and the developed country parties honour their commitments by providing financial and technological resources to enable Guyana to realize the implementation of the activities listed in the plan.

(c) Energy Policy

The energy sector is receiving extensive consideration from the government because energy is seen as an important driving force for growth and development. Consequently, a National Energy Policy was prepared in 1994. The objectives of this policy are to: (a) provide stable, reliable and economic supply of energy; (b) reduce dependency on imported fuels; (c) promote, where possible, the increased utilisation of domestic resources; and (d) ensure that energy is used in an environmentally sound and sustainable manner. A national development strategy chapter on energy supplements the National Energy Policy.

(d) National Development Strategy 2001-2010

While the National Development Strategy makes no direct mention of global warming and the impacts of climate change and impacts in Guyana, the general theme of environmental problems, especially in the coastal zone, addresses some of the potential problems associated with these issues. The important connection between the objectives of the Strategy and climate change can be examined as follows:

- The impacts of climate change will definitely delay the realization of the objectives, as resources will have to be set aside for emergency operations with regards to floods, droughts, etc. The coastal zone will be expected to come under further “stress” as the impacts become evident
- Economic development will depend on a reliable energy supply. The transfer of technology to energy, industry and local community sectors, with financing from developed countries, can certainly assist in promoting economic development and poverty alleviation

- The Strategy recognises institutional weaknesses as a major hindrance to integrated planning and effective execution of programmes and activities. The Climate Change National Communications also identifies capacity building as a necessary programme to address adaptation and mitigation activities.

The Climate Change Action Plan should, therefore, be seen as an important supplement to the Strategy, and socio-economic development programmes should take into consideration the activities which have been included in the Action Plan.

6. Key sectors

The sectors and systems identified as most vulnerable to the effects of climate change are listed below.

- Agriculture
- Human settlements on the coasts
- Health.

7. Overview of research and studies on climate change

(a) CPACC Project

Through the implementation of the CPACC project, Guyana has benefited from the following:

- Under Component 1, a Sea Level/Climate Monitoring Network was designed for the 11 participating CPACC countries, and provided a standardised set of instruments to measure water levels, vertical land motion, air and sea temperature and velocity, precipitation, and other site specific variables
- An inventory of coastal resources was compiled
- Under Component 4, Guyana prepared the framework for a National Climate Change Policy and Implementation Plan and it was subsequently approved at the political level
- Under Component 6 of the CPACC project, initial coastal vulnerability and risk assessments was carried out for Guyana.

(b) ACCC Project

Through the implementation of the ACCC project, Guyana benefited from the following outcomes:

- Development and distribution of risk management guidelines for climate change adaptation decision making
- Development of a guide to assist EIA practitioners in CARICOM countries to integrate climate change in the EIA process
- A draft regional PEO strategy
- Development and handover to the MACC Project, of the CCCCCs website
- Successful launch of a Master's Programme in climate change where the first students graduated, in 2003

- Staff training and development at the CIMH in climate trend analysis, in order to strengthen climate change capacity
- Implementation of pilot projects on adaptation studies in the water, health and agriculture sectors.

(c) MACC Project

The MACC Project commenced in 2004 and ended in December 2008. The project's main objective was to mainstream climate change adaptation strategies into the sustainable development agendas of the small-island and low-lying States of CARICOM. This initiative adopted a learning-by-doing approach to capacity building, consolidated the achievements of the CPACC and ACCC, continued to strengthen institutional capacity and the knowledge base, and deepened awareness and participation of stakeholders. Project components include:

- Building capacity to identify climate change risks which involve the strengthening of networks to monitor impacts on regional climate, downscaling global climate models, and developing impact scenarios
- Building capacity to reduce vulnerability to climate change
- Building capacity to effectively access and utilise resources to minimise the costs of climate change
- Public education and outreach.

(d) Post-disaster Assessment

ECLAC has conducted a post-disaster assessment of the floods Guyana experienced in 2005. The results can be found in the document entitled "Macro-Socio Economic Assessment of the Damage and Losses caused by the January-February 2005 Flooding".

(e) Iwokrama Forest Studies

Iwokrama intends to develop estimates of the carbon storage function of tropical forests, which could inform economic consideration of this forest's value. Studies which have been conducted are:

- A study on the quantification of the short-term carbon stock responses to reduced impact logging and conventional logging practices in Guyana: This was a MSc. Thesis by University of the West Indies postgraduate student Khemraj Parsram
- The delineation of seasonal flooding of tropical forests using high resolution radar: This was a joint study by Vijay Datadin (Iwokrama), Dr. Bruce Chapman (National Aeronautics and Space Administration [NASA] CalTech Jet Propulsion Laboratory) and Dr. Eileen Helmer (United States Department of Agriculture [USDA] Forest Service International Institute of Tropical Forestry). It was determined that the sequestering ability of forested areas is influenced by the flooding of those areas during the wet season. The researchers looked at the delineation of this phenomenon using high resolution canopy-penetrating satellite radar, demonstrating the application of recent advances in technology in a real world management context, and providing data to help fine tune bulk scientific and economic estimates
- A spatial and temporal study of total biomass and carbon content (standing biomass, leaf litter, soil organic matter) of several key forest types within the Iwokrama Forest: The study has established new permanent study plots in the forest and a neighbouring area. It will also

look at variations in species. This was a study conducted by Dr. Raquel Thomas (Guyana Forestry Commission)

- A study estimating biomass for forest types in Guyana – with a view towards informing carbon offset discussions: This was a consultancy by Dr. Hans ter Steege of Utrecht University of The Netherlands.

8. Other initiatives relevant to climate change

(a) Guyana's Low Carbon Initiative³⁰

In collaboration with the Government of Guyana and the Commonwealth Secretariat, the Iwokrama International Centre and its partners are seeking a new means to bring the world's remaining rainforests into the global economy, without losing them in the process.

Canopy Capital, in collaboration with the Iwokrama International Centre and the Government of Guyana, is now formulating a financial instrument to enable international institutions and other private investors to participate in determining the value of the forest, which can be attributed to the ecosystem services it provides. Under a capital-protected mechanism, income generated from the instrument would be shared equitably between investors, Iwokrama, the Government and the people of Guyana. Investors would receive assurance of the forest's protection and the continuing delivery of the services for which they are paying. The Iwokrama Centre, working closely with the local communities, would allocate income towards its research and conservation activities, and the Government of Guyana would apply its share of the proceeds towards adaptation to climate change and sustainable development.

This initiative could encourage the international community to recognise the value of all standing forests and develop mechanisms to allocate funds for their ongoing protection as the best, most immediate and cost-effective manner in which the world can tackle climate change. However, markets for forest services will not develop on their own. There is need for a governance framework to manage this initiative given the fact that carbon markets have risen from US\$0 to \$60 billion in only three years. It remains to be seen whether such instruments can be developed, following the outcome of the Copenhagen Conference of the UNFCCC at the end of 2009, and through new activities pursued by the World Bank and other international financial institutions.

Canopy Capital and the Iwokrama Centre believe that, instead of converting finite natural capital into extractable goods, it would be more beneficial to redirect capital towards the maintenance of the significant eco-system services of the world.

(b) The Guyana Shield Project

Guyana is home to less than one million people, and 80% of its land is forested with pristine standing rainforest known as the Guyana Shield – an area larger than England. This forest is one of only four remaining intact forests on the planet, and contains the Iwokrama Reserve, an area which was gifted to the Commonwealth almost 20 years ago as a reserve for conservation projects. It is hoped that the project will not only safeguard this vital rainforest, but also provide a measure of financial security for the people of Guyana.

A deal has been reached in March 2009 to place a financial value on rainforests and the vital functions they perform in rainfall generation, carbon storage and climate regulation. The deal will put

³⁰ Excerpt from Guyana: Iwokrama and Climate Change, Dec. 8, 2008. <http://www.mondaq.com/article.asp?articleid=70800>

around one million acres of pristine Guyana rainforest under protection, and open the way for the world's financial markets to play a key role in that protection.

Last year, Guyana offered to place its entire standing forest under the protection of an international environmental body, in return for development aid. Following an agreement at the UNFCCC climate summit in Bali of 2008, the deal will finally put financial recognition to the vital services rainforests provide for our planet, making rainforest conservation a valuable global commodity.

The world's scientific community has accepted that the deforestation of tropical rainforests is one of the biggest contributors to greenhouse gas emissions, and that disappearing forests are forming a cooling band around the equator.

(c) Sea Defences

The "rip rap" design of the seawall around the coast of Guyana, allows for the raising of defences against overtopping and accommodation of the projected of sea level rise.

(d) Co-generation at a Sugar Factory³¹

The Guyana Sugar Corporation is currently engaged in negotiating a power purchase agreement with the Guyana Power and Light Inc. Following successful sugar production at the factory in March 2008, bagasse was accumulated to facilitate a test of the generators at the factory that would supply electricity to the national grid. This would also mark the largest leap in bio-fuel energy in Guyana's history, but not the first, given that the Wauna Palm Oil project has been producing bio-diesel for electricity in Region One.

The connection to the national grid at Skeldon would only be made possible when the power cables required are in place. The Chinese Government has committed a US\$40 million loan to facilitate the installation of power lines from Parika to Berbice.

(e) Wauna Palm Oil Biodiesel Project

The Wauna Oil Palm Estate was established by the Ministry of Agriculture in the 1970s as a pilot project to test the viability of cultivating oil palm in Guyana. The Government's interest in the development of a vibrant agro-energy sector was heightened with the agreement signed in 2006 between Agri-Supplies Technology Incorporated and the Regional Administration of Region One, for the supply of bio-diesel to that region. The fuel was produced at the Wauna Oil Palm Estate, Region One, which was upgraded to produce bio-diesel, following a joint venture between IAST and a private investor from Canada.

A pilot project was initially carried out in Region One to test the supply of fuel produced at the estate. The success of the experiment resulted in one of the first agreements for the commercial supply of bio-diesel. The AST has successfully supplied bio-diesel to the local administration for use in its electrical generators for the last year, and many vehicles in the region are running on 100% bio-diesel.

³¹ Excerpt from "Co-generation at New Sugar Factory – Skeldon close to Selling Power to GPL". Oct. 11, 2008. <http://www.kaieteurnews.com/2008/10/11/co-generation-at-new-sugar-factory%e2%80%a6-skeldon-close-to-selling-power-to-gpl/>

(f) Climate Change and Biodiversity Project

Through the Office of the President, the Government of Guyana has agreed with the IDB to carry out a technical assistance operation, “Climate Change and Biodiversity Mainstreaming through Avoided Deforestation”, which will be financed by the Fund for Special Operations and the IDB-Netherlands Partnership Programme in Environment. The project will focus on measurements and methodologies required to analyze forest changes and resulting emission levels, as well as projected future emissions and scenarios. The Georgetown-Lethem corridor will be the area of study for the project.

The project will include the following key activities: (a) carrying out a carbon stock assessment to determine estimates of deforestation, forest degradation and greenhouse gas emissions; (b) monitoring forest carbon; ensuring institutional policy to facilitate the environmental corridor; and (c) analyzing potential financial flows from REDD.

(g) Hydro-power

Guyana is expected to have a multi-million dollar hydro-power plant in 2010 with the capacity to generate 100 MW of power which will be transmitted to the national grid. This project holds tremendous potential for the development of Guyana.

Following the obtaining of technical advice that the project is economically feasible, the Government of Guyana, Synergy Holdings and the Guyana Power and Light Inc., entered into a Memorandum of Understanding on May 23, 2008. This Memorandum provided for the development of the power station at Amaila Falls hydro-electric project at the Kuribrong River in Region Eight (Potaro/Siparuni). Power generated at the falls would be fed into transmission lines that lead to the Sophia, Greater Georgetown sub-station, which is presently operated by the GPL Company.

9. Relevant data on Guyana

(a) Meteorological and climatological data

The Hydro-meteorological Service (<http://www.hydromet.gov.gy/about.html>) is attached to the Ministry of Agriculture. The department’s general responsibility is to monitor and evaluate the weather and water resources in Guyana, and to actively support the government, aeronautical, water, agriculture, engineering, and other agencies in disaster risk management and socio-economic development of the country. It is the official provider of weather, water and climate information and related products and services for Guyana.

The collection of rainfall data began as early as the nineteenth century, but this was done under the auspices of the various ministries and sugar estates. The overall mission of the Service evolves from separate basic activities:

- Monitoring: Observation and data collection to meet the needs of future generations for reliable, homogeneous national climatological, hydrological and oceanographic data
- Research: Research directed to the advancement of hydrological, oceanographic and meteorological sciences, and the development of a comprehensive description and scientific understanding of Guyana’s weather, climate and water resources
- Services: Provision of hydrological, meteorological, oceanographic and related data, information, forecasts, warnings, investigation and advisory services on national, as well as international bases

- International: Coordination of Guyana's involvement in regional and international hydrology, meteorology, oceanography and related conventions.

(b) Comprehensive socio-economic data

The Bureau of Statistics (<http://www.statisticsguyana.gov.gy/index.html>)³² was incorporated as a semi-autonomous body, outside the purview of the traditional Public Service, by an Act of Parliament in October 1990. The functions of the Bureau, which became systemized in 1965, are set out in section 4 (1) of the Bureau of Statistics Act No. 25 of 1991 and the Statistical Bureau Act Cap: 19.09, and can be summed up as follows: (a) conduct censuses; (b) collect, compile, analyse, and publish socio-economic and other statistical data; (c) collaborate with other Government departments in collecting, compiling, analysing and publishing statistics derived from administrative records; and (d) organise a coordinated scheme of social and economic statistics for Guyana.

The Bureau is the main coordinator and producer of economic statistics, including national accounts. The main data on population, economic and social conditions of households, stem from censuses and surveys. The Bureau is recognised as the central authority on statistics in this country, and is often requested to advise and assist ministries and private/public sector organisations on statistical matters. It is also a member of the Guyana team for reviewing International Monetary Fund (IMF) structural adjustment programmes and similar activities.

10. Needs and gaps

- Formal and informal education on the environment and climate change
- Capacity building for data collection
- Increased institutional capacity for addressing climate change issues
- Climate change impact studies on health and agriculture
- Costing of impacts and response options.

11. Conclusion and recommendations

Guyana is abundant in natural resources, including fertile agricultural lands on the coastal plain, vast areas of tropical forests, various ecosystems with a multitude of plant and animal species, large rivers and a wide variety of minerals. For the most part, Governments have always known the value of these resources and have deliberately set about to conserve them. While there is a lot to protect from the adverse impacts of climate change, there is also a lot that these resources can do to contribute to global emissions reductions. Unlike many other Caribbean states, Guyana's forest cover is extensive enough to make a significant contribution to sequestering carbon from the earth's atmosphere. These factors make a strong case for both large-scale adaptation and mitigation responses to be implemented.

Adaptation measures should be focused in the coastal zone and the agricultural sectors in the first instance, as a large percentage of the population resides in this plain, and it is the area of high soil fertility and easy access for agriculture. Mitigation programmes should continue to target improved forestry and agricultural management, as well as energy efficiency and the use of renewable energy resources. Guyana has tremendous potential for large renewable energy generation through hydro and solar power and bio-fuels.

³² The website provides very comprehensive datasets on socio-economic indicators which have been disaggregated spatially. The last population census was conducted in 2002.

The President of Guyana is the champion of climate change and this clearly demonstrates the country's commitment to this global challenge. Guyana has been a leader in the English-speaking Caribbean in terms of developing a policy for climate change adaptation. Early success in producing and utilising bio-fuels, and strongly stating the right for standing forests to be recognised for their mitigative potential has certainly shown the country's interest in addressing climate change.

Through various initiatives, Guyana has deduced its physical impacts from climate change at both national and individual sector scales. However, these are not specific or quantified, and this is needed so that the best possible interventions are made, particularly for adaptation.

Due to its size and the relatively recent opportunities for capacity building in climate change expertise, Guyana's ability to respond and take mitigative actions against the impacts of climate change is inadequate. This is simply due to the fact that there are not enough technically trained human resources. The country will require substantial assistance to provide the relevant training and capacity to successfully carry out all ongoing and planned programmes.

Table 8
List of participants at the consultations in Guyana

Name	Organization	Position	Tel/Fax	E-mail
Professor Suresh Narine	Institute of Applied Sciences and Technology (IAST)	Director	-	
Mr. Collin Croal	Institute of Applied Sciences and Technology (IAST)	Deputy Director of Administration	222-4214 663-3282 (mobile)	Depdir_iast@yahoo.com
Hon. Robert Persaud	Ministry of Agriculture	Minister	592 226-5165	minister@agriculture.gov.gy
Mr. Shyam Nokta	President's Office	Advisor to the President on Climate Change and Chairman of the National Climate Change Committee	592- 222 4565 592- 623 0269 (mobile)	shyamnokta@gmail.com
Gitanjali Chandarpal	Guyana National Climate Unit	Coordinator	592-225 5842	Gitanjalie81@yahoo.com ncuguyana@yahoo.com
Parmeshwarie Pitamber (Annie)	Guyana National Climate Unit	Project Coordinator for Guyana's Second National Communications to the UNFCCC	592 -225 5842	Snc_gy@yahoo.com
Navin Chanderpal		Advisor to the President on Sustainable Development		
Nasheta Dewnath	592- 223 5061 592 -615 2777 (mobile)	Secretary to the National Climate Change Committee		ndewnath@gmail.com
Bal Parsaud	Director	Director	592- 265 2087	bparsaud@demrum.com

12. Guyana costing adaption measures for climate change

Source: <http://www.kaieteurnews.com/?p=11378>, October 19, 2008, By Tusika Martin

The cost of adapting to climate change and the effects of climate change on Guyana are being assessed by consultants from ECLAC.

At the commissioning of the office of the Food and Agriculture Organization (FAO) in Guyana, President Bharrat Jagdeo had announced that Guyana is working with an international consultancy firm to look at the cost for adaptation.

The President stated that it will require billions of dollars for a proper adaptation policy to be funded in Guyana, but he noted that if the country does not adapt properly, then it would have a devastating impact on the agricultural sector.

Dr. Charmaine Gomes of Trinidad and Tobago, the consultant who is working on the project for ECLAC, in an exclusive interview with Kaieteur News, said that it is the first time that the Caribbean is attempting to cost the adaptation process of climate change. She said that there has been a lot of activity surrounding climate change and the environmental impacts.

Dr. Gomes told this newspaper that what ECLAC is attempting to do is not only to look at environmental impacts, but also to look at economic and social impacts of climate change in the region.

“We have added on to the climate change approach by including social and economic impacts. Nicholas Stern, an economist from Britain, produced a Stern Report on these impacts. Our end product is to produce a ‘Stern Report for the Caribbean,’ and so we refer to it as a ‘Stern Type’ Report for the Caribbean”, Dr. Gomes said.

The project is being funded by the United Kingdom’s Department for International Development, and is being carried out by ECLAC. Reports of the same nature are also being carried out in Central and South America. The project, which began on October 1, last, is being carried out in three phases. As part of the first phase, ECLAC will be conducting what is referred to as a “scoping study” in 10 selected countries in the Caribbean. Dr. Gomes said that, because of time and cost, it will not be possible to travel to each of the 24 countries in the region to do a “scoping study”. “We are going to these 10 countries to host stakeholder consultations. We have invited the stakeholders in these ten countries to come together, very informally, for us to present the project. After that, we get their views on how they see climate change in their country, with emphasis on economic impacts”.

At the end of this phase, national reports will be produced and reviewed by regional climate change specialist Judi Clarke. The project is going to last 18 months.

“We want to cost these impacts. We know a lot about the impacts – sea level rises, temperature rises, and problems with food production – but we have not cost this for the region as yet. We believe that the cost of action really outweigh the cost of inaction”, she said. Phases two and three of the project, she added, will look at conducting the Stern Type Report by doing economic modeling. Addressing the effects of adaptation on the economies of developing countries, Dr. Gomes said that it will cost countries “heavily”.

Dr. Gomes, who was recently in Guyana, met with the Climate Change Committee, Climate Change Unit within the Ministry of Agriculture, and members of the private sector.

JAMAICA



Source: <http://www.worldtravelguide.net/country/130/map/Caribbean/Jamaica.html>

E. JAMAICA

1. Introduction and brief summary of the discussions

ECLAC the Consultant met with several small groups of stakeholders on 21 and 22 October 2008 (See table 9 for schedule).

Table 9
Schedule of consultations in Jamaica

Date	Time	Organisation
21 Oct. 2008	9:00-10:00	Environment: <ul style="list-style-type: none"> ▪ Office of the Prime Minister ▪ Meteorological Service ▪ National Environment & Planning Agency ▪ Ministry of Health ▪ Ministry of Foreign Affairs
		Planning: <ul style="list-style-type: none"> ▪ Planning Institute of Jamaica ▪ Department of Local Government. ▪ Association of Local Government Authorities ▪ Office of Disaster Preparedness ▪ National Solid Waste Management Authority ▪ Statistical Institute of Jamaica ▪ Ministry of Finance & the Public Service
	9:30-12:00	Water: <ul style="list-style-type: none"> ▪ Ministry of Water & Housing ▪ Water Resources Authority ▪ National Water Commission ▪ National Irrigation Commission
		Agriculture: <ul style="list-style-type: none"> ▪ Ministry of Agriculture ▪ Forestry Department ▪ Fisheries Division ▪ National Land Agency
		Energy/ Technology: <ul style="list-style-type: none"> ▪ Ministry of Energy ▪ Wigton Wind Farm ▪ National Commission of Science and Technology ▪ Scientific Research Council ▪ Ministry of Transport & Works ▪ National Works Agency
22 Oct 2008	9:00-10:30	UN & other Agencies: UNDP, UNEP, UNICEF, UNESCO,FAO, PAHO, USAID, IADB, EU
	10:30-12:00	<ul style="list-style-type: none"> ▪ NGOs/Civil Society ▪ Private Sector / Professional Organisations

The National Climate Change Focal Point was present at the consultation and gave a background on Jamaica's obligations and activities under UNFCCC. It was clear that the 2°C increase in temperature predicted by the IPCC and deemed to be tolerable for the global climate, was not acceptable for small island developing states. This warming will cause significant sea level rise and have negative impacts on already stressed ecosystems.

The Second National Communication is almost completed for the country. The vulnerability and adaptation assessments for the water, tourism, human health and agricultural sectors, as well as the coastal zone areas have also been completed.

Although it is clear that Jamaica should adapt to adverse climatic effects, mitigation was seen as a practical opportunity to reduce dependence on fossil fuel, as well as serve as a response to climate change.

Potable water is not always available in Parishes such as Manchester. Experts say that the geology and high altitude of the major population centers in Manchester, including its capital Mandeville, make water shortage a chronic difficulty. Many communities in neighbouring Parishes, such as St Elizabeth, are often left with no running water, or at best, an inconsistent supply. As a result, rainwater harvesting is heavily promoted in these areas.

Jamaica has embarked upon the preparation of a 25-year National Development Plan – Vision 2030 Jamaica, which is expected to place the country on a path towards achieving a developed country status by the year 2030. The Plan is based on a comprehensive vision: “Jamaica the place of choice to live, work, raise families, and do business”. It also refers to guiding principles which put people at the centre of Jamaica's transformation. Among its many positive attributes, the plan brings a more coherent, collaborative, efficient and transparent approach to the process of national development planning. As a planning tool, it supports the integration of economic, environmental and social elements of society, and provides scenarios of future long term outcomes and project consequences of different strategies across a range of indicators.

2. Country overview

Jamaica is located in the Greater Antilles or the western Caribbean. It is the third largest island in the Caribbean with a land area of 10,991 km² (4,411 sq. miles). Jamaica is 236 km long, 35 km wide at its narrowest point and 52 km at its widest part.

The coastal plain is less than 3.2 km (2 miles) wide along most of the north coast. On the south coast, the plains widen to form broad embayments, the most extensive of which are located at the eastern and western ends of the island and the Clarendon and St. Catherine Plains. The prime agricultural lands are mostly located on the southern coastal plains and interior valleys.

Jamaica's tropical maritime climate is modified by north or northeast trade winds and land-sea breezes. Rainfall and temperature patterns vary according to location and altitude, and are marked by monthly, annual, and spatial variability. The average annual rainfall for the entire island is 195.8 cm. The Blue Mountains and northeast coast lying in the path of the trade winds receive the highest annual rainfall of over 3300 mm.

Historically, Jamaica had an open economy. It has faced periodically depressed and highly competitive markets for its principal exports and sources of foreign exchange (tourism, bauxite, alumina, agriculture, and light manufactured goods). Tourism is an especially important industry in the Jamaican economy.

Jamaica is classified as a country of “medium human development”, whose social indicators compare favourably with many Latin American and Caribbean countries. The capacity of the State to fund and deliver social services and their supporting infrastructure has been reduced however, due to financial and economic problems. Jamaica ranks as 78th among 175 countries with a Human Development Index of 0.742.

Natural and environmental resources are deteriorating in Jamaica, partly due to the development and operation of critical sectors in the economy such as tourism, agriculture, manufacturing, mining and quarrying. In turn, the negative impacts on the environment jeopardises these industries and society at large. Furthermore, the effects of climate change are already being experienced in the country. However, the economic losses resulting from resource degradation are difficult to quantify or measure and as a result, they are not yet reflected in Jamaica’s national accounts. Conservation of the natural resources is therefore not easily viewed as critical to sustaining the economy.

3. Overview of Jamaica’s participation in international and regional climate change responses

Jamaica became a Party to UNFCCC in January of 1995, and ratified the Kyoto Protocol in June 1999. Its Initial National Communications was submitted in 2000.

Since becoming a Party to UNFCCC, Jamaica has implemented climate change activities at the regional and national levels. These include:

- Participation in CPACC regional project: 1998-2001
- Participation in ACCC regional project: 2001-2004
- Participation in MACC regional project: 2004-present
- Executing climate change enabling activities, expedited funding in Priority Areas project.

Additionally, in August 2004 through the expedited financing for capacity-building interim funds, US\$100,000 was obtained for maintaining and enhancing the capacity to prepare future National Communications. The project is being implemented by the Meteorological Service over 12 months and the main activities are:

- Identification and submission of technology needs
- Capacity building to assess the modalities to acquire and absorb technology needs, as well as design, evaluate and host projects
- Capacity building for participation in systematic observation networks
- Preparation of programmes to address climate change.

4. Institutional framework to address climate change

(a) Meteorological Service

The Meteorological Service is recognised as Jamaica’s primary institution for climate change and related issues. This is based on provisions that were made for the establishment and maintenance of a network of national focal points for the Convention. Parties not included in Annex I were invited by the Subsidiary Body for Implementation (SBI) to nominate national focal points for the facilitation and preparation of national communications.³³ Furthermore, the Subsidiary Body for Scientific and

³³ FCCC/CP/1996/6/Add.2, 4 July 1996

Technological Advice (SBSTA), at its second session, “invited Parties to identify the relevant governmental authority/ministry authorized to accept, approve or endorse activities implemented jointly and to report them to the Conference of the Parties (COP) through the UNFCCC secretariat”.

The Meteorological Service has been involved in the mainstreaming of climate change activities longer than any other Jamaican institution. This was first accomplished by the Directors of the Service in their role as Jamaica’s Permanent Representative to the World Meteorological Organisation, the international organisation responsible for bringing climate change issues to the world’s attention.

The Service has assisted the Project Coordinator for the project “Preparation of Jamaica’s Initial National Communications to the UNFCCC” and the National Coordinator in the preparation of Jamaica’s National Issues Paper for Integrated Adaptation Planning and Management.

The climate change focal point is the main negotiator for climate change issues in Jamaica. These negotiations are facilitated through the sessions of the SBI for Implementation and the SBSTA, and the annual Conference of the Parties of the UNFCCC. Nationally, the Focal Point is responsible for coordinating the implementation of climate change enabling activities, in particular the preparation of national communications. Other roles of the National Focal Point include:

- National representative to the sessions of the Subsidiary Bodies (SBSTA, SBI)
- National representative to the Conference of the Parties to the Convention
- Bureau member of COP 9 representing GRULAC
- Chair Group of Latin America and the Caribbean (COP 9)
- Coordinator for Contact Group on The Implementation of Articles 4.8 and 4.9 of the Convention (Buenos Aires Programme of Action, 1998) for Alliance of Small Island States (AOSIS)
- Representative of Group 77/China for special meetings with the United States of America (COP 6 II) representing AOSIS
- Regional Coordinator for Conference for Comprehensive Disaster Management activities in the Caribbean (2004)
- National Representative to sessions and plenary of IPCC.

(b) Sustainable Development Council of Jamaica

To address the issue of sustainable development and in keeping with the Barbados Programme of Action (BPoA), the Government of Jamaica established the Sustainable Development Council of Jamaica in 1996, facilitated by UNDP under the Regional Capacity 21 project. The mandate of the Council is to “sensitise key players and decision makers at all levels of the society by facilitating dialogue on the importance of sustainable development and the responsibility it imposes on Government and other sectors and interests in the society, as well as the need for all to work together in an integrated and coordinated manner”.

(c) Sustainable Development Policy Unit

In June 2002, the Sustainable Development Policy Unit was established within the Planning Institute of Jamaica (PIOJ), with the mandate to ensure an effective, integrated, coordinated approach to sustainable development. The Unit’s initial focus is on three broad areas: strategy design and co-ordination, data and information management, and governance.

5. Legislative and policy framework to address climate change

(a) National Climate Change Policy

A National Climate Change policy was drafted under CPACC in 2001, but this has not been further developed.

(b) Building codes

Development Orders are undergoing revision and will include climate change considerations – particularly for the coastal zone areas.

(c) National Energy Policy

A National Energy Policy has been drafted and is at the White Paper stage. It includes the production of bio-fuels, the trading of carbon credits, and a mandate for the percentage of renewable sources required to provide electricity by 2010.

Climate change concerns are not included in any of the relevant legal instruments, policies and/or non-regulatory mechanisms of Jamaica. There is currently only one piece of draft legislation which refers to climate change namely in the area of the air quality regulations being produced by the National Environment and Planning Agency (NEPA), which refers to GHGs.

Table 10
Jamaica's legislation with relevance to climate change

Agencies	Relevant Legislation
National Environmental Societies Trust	<ul style="list-style-type: none"> ▪ Natural Resource Conservation Authority (NRCA) ▪ Beach Control ▪ Fisheries Act ▪ Forestry Act
Water Resources Authority	<ul style="list-style-type: none"> ▪ Water Resources Authority (WRA) Act ▪ Management of Resources Regulations ▪ Protection from Pollution Regulations ▪ Flood Water Control Management Regulations
National Environment & Planning Agency	<ul style="list-style-type: none"> ▪ Town & Country Planning Act ▪ Town & Country Planning Regulations ▪ Natural Resources Conservation Act ▪ Natural Resources Conservation Regulations ▪ NEPA Act (being drafted) ▪ NRCA Act ▪ Beach Control Act ▪ Watershed Act ▪ Wildlife Act ▪ Land Utilization Act
Ministry of Land & Environment/NEPA	<ul style="list-style-type: none"> ▪ Watershed Act ▪ Watershed Policy ▪ Hazard Mitigation Policy ▪ Legislation controlling importation of Ozone Depleting

	Substances <ul style="list-style-type: none"> ▪ National Bio Safety Action Plan ▪ Beach Policy ▪ Policy on Oceans and Coastal Zone Management
Forestry	<ul style="list-style-type: none"> ▪ Forest Act of 1996 (Update needed) ▪ National Forestry and Conservation Plan (2001) ▪ National Planning Act (needs to be reviewed)
Office of Disaster Preparedness, Emergency and Management (ODPEM)	<ul style="list-style-type: none"> ▪ Disaster Preparedness and Emergency Relief Coordination Act of 1993 ▪ Disaster Preparedness and Emergency Management Act

6. Key sectors

The following sectors were articulated as being the most vulnerable to climate change:

- Tourism
- Health
- Agriculture (particularly as it relates to food security and nutrition).

7. Overview of research and studies on climate change

(a) First National Communications

- This comprised 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 that its capacities permit using comparable methodologies to be promoted and agreed upon by the Conference of the Parties
- A general description of steps taken or envisaged by the Party to implement the UNFCCC
- Any other information that the Party considers relevant to the achievement of the objective of the UNFCCC and suitable for inclusion in its communication, and inserting material relevant for calculations of global emission trends, if feasible.

(b) Second National Communications elements

- Compiled for the years 2000-2005
- Anthropogenic emissions of carbon dioxide, nitrous oxide and methane by source, and removal by sinks and are encouraged to report hydrofluorocarbons, Perfluorocarbons, and sulphur hexachloride
- Using the 2006 revised IPCC guideline
- GHG inventory
- The impacts/vulnerability that have been observed/experienced, and their underlying drivers (current vulnerability assessment)
- The potential impacts and vulnerabilities under projected climate and projected socio-economic conditions (future vulnerability assessment)
- The adaptive responses that will be required to reduce vulnerability (adaptation assessment)
- The implications for sustainable development (policy recommendations).

(c) Vulnerability to Dengue in Jamaica

This study was led by the Climate Studies Group at University of the West Indies (UWI) Mona, and found that incidences of dengue fever in the Caribbean have historically coincided with times of high temperatures and high rainfall. This is alarming for two main reasons. First, the tropical climate of the Caribbean now features continually increasing temperatures and second, most Caribbean countries are developing nations.

(d) Climate Change and Water Resources

Jamaica, led by the team of Environmental Solutions Limited consultants, is now in the process of completing its consultation for the Draft National Water Sector Adaptation Strategy to address climate change in the island. The work is being initiated under the MACC project of the CCCCC.

(e) Climate Change and Agriculture Study

The Climate Studies Group at UWI, Mona is leading a study which seeks to model the impacts of climate change on agriculture in Jamaica.

(f) Storm Surge mapping

Originally, storm surge mapping was only completed for Montego Bay, under the Caribbean Disaster Mitigation Project. However, the entire island is being currently being mapped.

(g) Coastal Vulnerability Studies

In light of current concerns about the possible effects of sea-level rise, the Marine Geology Unit undertook an investigation on the elevation of the barrier beach complex making up the Negril strip above sea-level. The field survey consisted of generating some 200 networked elevation points tied to a reference point and an average sea-level. This was accompanied by a preliminary analysis of aerial photographs and satellite imagery to determine the magnitude and disposition of shoreline changes over the past 45 years. The survey showed that most of the southern section of Long Bay on the seaward side of the main road is less than 2 m and in some places less than 1.5 m above sea-level. Detailed photo analysis also revealed two “hot spots”, one between Conch Hill and the northern boundary of Swept Away, and the other centered on the Urban Development Corporation Beach Park. Assuming that future erosion rates will be directly linked to future rates of sea-level rise, then average projections for the entire area of Long Bay, using the base year of 2003 as a starting point, are suggesting to be as much as 3.5 m to 5 m by 2015; 9 m to 14 m by 2030; and 17 m to 32 m by 2050. In the hot spots, coastal recession is likely to be much higher.

(h) Saltwater Intrusion of Coastal Aquifers on Caribbean Islands

Caribbean Environmental Health Institute (CEHI) has been engaged with UWI to assist with this project. Specifically, CEHI is responsible for:

- Review of the current methods of monitoring relevant to the management of saltwater intrusion in the pilot countries (Antigua, Barbados and Jamaica). The review would also include all technical specifications of present and proposed equipment for saltwater intrusion monitoring
- Review of the current and proposed legal, institutional and administrative framework and arrangement for developing groundwater surveillance and monitoring network for saltwater

intrusion. In addition, the review would also consider the technical capability and capacity of the various institutions in the country to participate in the groundwater surveillance and monitoring programme.

(i) The PRECIS Initiative

Providing Regional Climates for Impacts Studies (PRECIS) was designed by British Government scientists and is now applied to Caribbean nations. Since 2007 Jamaica, Barbados, Belize and CCCCC have been sharing human resources and technology to map out possible storm scenarios, using Cuban-designed computer programmes.

UNEP is also participating in programmes headed by CARICOM, which aim to minimize storms impacts and avoid droughts, forest fires, environmental damage to beaches and endangered species, as a result of damage to the global ecosystem.

8. Other initiatives relevant to climate change

(a) Wigton Wind Farm

Under the CDM of the Kyoto Protocol, the Petroleum Corporation of Jamaica and a number of partners have invested in the construction of a 20 Megawatts wind farm at Wigton, Manchester. The island's electricity provider has already committed to purchasing this alternative source of energy.

(b) Expedited Financing for Capacity Building in Priority Areas (Jamaica Climate Change Enabling Activity Project, Phase II)

The expedited financing for capacity building provides additional interim funds of US\$100,000 for maintaining and enhancing the capacity to prepare future National Communications. The project was implemented by the Meteorological Service and commenced in August 2004. The project was of 12 months duration and the main activities included identification and submission of technology needs, capacity building and preparation of programmes to address climate change.

(c) Reducing Climate Change-Driven Erosion and Landslide Risks through Sustainable Agriculture for Safer Slopes

The upper slopes of Jamaica's Blue Mountains are an important protected area, while the lower slopes are key coffee-growing areas. Climate change impacts, including stronger hurricanes and more intense drought, threaten to increase erosion and landslide risks. This places communities in danger, threatens livelihoods, and impacts a crucial watershed serving the city of Kingston. In response, the Jamaica Conservation and Development Trust Project will reduce these climate-driven erosion and landslide risks through reforestation and agro-forestry, while building the capacity of local farmers to manage ongoing climate change pressures. By promoting more forest cover, the project will also contribute to maintaining the misty and cool microclimate required for Jamaica's signature Blue Mountain Coffee. In turn, this will reduce pressures that might lead farmers to migrate upslope in search of better land or more suitable microclimates for their crops.

(d) Land and Preservation Measures to Combat Climate Change Pressures in Cockpit Country's Martha Brae Watershed

The Cockpit country is Jamaica's last remaining wilderness area with 20,234 hectares of forest reserve, and large tracks of Crown lands and private land holdings. The area experiences on average 250-

380 cm of rainfall annually which recharges and supplies the main river systems. The heavy rainfall season of April to May and September to October account for 47% of the total annual rainfall.

(e) Green Globe Certification

The Ministry of Tourism is working with Green Globe International to develop the latter's Carbon Neutrality Programme in Jamaica. Many of the large hotels in Jamaica are already Green Globe certified.

(f) Zoning Plan

The Ministry of Agriculture is working with NEPA to develop a zoning plan for flora and fauna. NEPA has decided to systematically increase monitoring sites until a representative number is achieved and the data being gathered can properly inform management decisions. Additionally it is the intension of the Government of Jamaica to improve the management of protected areas through the promulgation of zoning plans and regulations for all existing protected areas, especially those that are marine-based.

(g) Disaster Management for Sustainable Tourism

Tourism and disaster management stakeholders across the Caribbean are collaborating to implement the Regional Disaster Risk Management for Sustainable Tourism in the Caribbean Project, by June 2010. Under the project, a Regional Disaster Risk Management (DRM) Strategy and Plan of Action for the Tourism sector will be developed, through the collective input of regional and national tourism and disaster management interests.

The initiative is being spearheaded by CDEMA, with support from the IDB which is funding the project. The Caribbean Tourism Organization (CTO), the Caribbean Community Regional Organisation for Standards and Quality, and UWI, are the other key stakeholders involved in the development of the project.

The strategy will seek to harmonise national practices to promote region-wide sustainable tourism and foster the transfer of knowledge, skills and experience on key issues of disaster risk management. It is expected that the strategy will provide the model for the development of future national disaster risk management strategies and action plans for the tourism sector in the Caribbean.

(h) Thermal Energy Storage Air Conditioning System for the Cornwall Regional Hospital

Terms of reference for the design of an Ice Thermal Energy Storage Air Conditioning System for the Cornwall Regional Hospital have been prepared. This will be sent to consultants as part of a package to invite bids for their service to design the system.

The Cornwall Regional Hospital is a 400-bed institution located in Montego Bay, St. James. Currently, there are four 100-ton, chilled water, central air conditioning systems and more than 60 mini-split systems installed in the hospital. Each of the chilled water systems comprises an air-cooled reciprocating chiller, at least one air handling unit, chilled water pumps, piping and ducts. These central systems are about 25 years old and in need of replacement, because two of these systems are already out of service and the remaining two incur high maintenance costs while not performing efficiently. The mini-split systems, which were installed over time to compensate for the declining capacities of the central systems, will also be replaced, because they are not suitable for the application and their energy efficiency is too low. The main reason for replacing the existing systems is therefore to install a new system that has better energy efficiency, lower operating cost, and improved reliability.

(i) Energy Efficiency Implementation - Bustamante Hospital for Children

The energy efficiency projects, which are being pursued at the Bustamante Hospital for Children, are as follows:

- Installation of six solar water heaters and extension of hot water piping
- Installation of power factor correction equipment
- Lighting efficiency improvement
- Insulation of steam distribution lines.

(j) Panos Mocho Oral Testimony Project – Communicating climate change and disaster reduction: The Mocho experience

The aim of Panos is to promote the use of communication as a development tool, particularly to reach marginalised communities and persons, and to increase their representation in the media and other institutions. Panos introduced the Oral Testimony Project to Mocho, Jamaica, to document the community's experience with environmental and climate change issues and communicate these to Jamaican, Caribbean and international audiences. Mocho is an environmentally degraded area with poor infrastructure and a generally negative image throughout Jamaica. Members of the community were trained in oral testimony methodology in order to undertake interviews with the men and women of Mocho. Devon Brown was one of those trained. He explained, the aim of the training was to gather first-hand accounts of the community's experiences and perspectives so that these could become a part of wider debates on environment and development. The process was also intended to mobilise community members to find solutions to environmental problems, such as land degradation in their community.

Key messages were documented about climate change and attitudes to disaster preparedness. The narrators discussed changes in rainfall and temperature, and increasingly unpredictable weather patterns. For example, one secondary school teacher reported that,

“When I was growing up, the 8th of August used to be the day to plant maize, and there were other dates for other crops, but now the farmers are confused by the weather and we have lost this certainty of when to plant crops”.

Indi Mclymont-Lafayette described how disaster preparedness skills in the area have been increased through community training by collaborative efforts of Panos Caribbean and the Jamaica Red Cross. This was undertaken partly as a response to the difficulties in recovery following hurricane Ivan. Awareness of disaster response is vital in rural communities, as access can be difficult for emergency services, and therefore communities must be prepared to support themselves.

Panos is undertaking a number of projects in Mocho to improve community representation and build capacity including, training youth journalists and the production of a bi-monthly newsletter. Future projects include setting up a community-based organization (CBO) in Mocho, which will focus on climate change and the environment among other issues.

9. Needs and gaps

- Impact studies for fisheries and livestock /poultry
- Standardisation protocol for data collection
- Data recovery /digitisation of some data
- Data on ocean current strength and direction

- More coastal surveys
- Use of other regional models that have better representation of land-based parameters
- Climate change impacts studies on all sectors – particularly in the health sector on respiratory diseases, re-productivity, and skin diseases.

10. Conclusion and recommendations

According to a report in 2005, although Jamaica signed the UNFCCC 13 years ago, it has not achieved as much as could have been reasonably expected within the given time frame. The main reason for this may be the lack of sustained focus on climate change activities, perhaps, due in part to the absence of the Climate Change Committee to guide and focus the country's programmes. Other reasons could be the relatively low levels of public awareness with respect to the implications of climatic change for national development, along with the absence of full political buy-in, in light of other pressuring social issues which are often the main focus of government actions.

While the initial national communications report has a preliminary investigation of potential vulnerabilities, there is a need for further work in the area of vulnerability with regards to climate change. There is a considerable amount of infrastructure located on the coast, with the international airport, seaports, and a number of industries being located in areas that would be extremely sensitive to climate change. It will also be necessary to investigate a number of the socio-economic vulnerabilities, particularly in the tourism sector. Additional funding will be required for a more thorough analysis of other areas including coastal zones, water resources, and also on the agriculture and health sectors.

Table 11
List of participants at the consultations in Jamaica

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MONTSERRAT



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F. MONTSERRAT

1. Introduction and brief summary of the discussions

Meetings with stakeholders took place on 13 October 2008 at the Headquarters of the Disaster Management Coordination Agency. Opening remarks were presented by the Director of the Department of Environment of Montserrat, and ECLAC delivered presentations on each of the Stern Review, the RECC and adaptation to climate change in the Caribbean by ECLAC.

Montserrat, as a developing Overseas Territory of the United Kingdom, is not party to the UNFCCC or the Kyoto Protocol. Montserrat has the unique circumstance of having to rebuild much of its infrastructure and commercial activity almost from the beginning as a result of the devastation caused by the major volcanic eruption in 1997. It lost virtually its entire essential infrastructure (including the airport), and its visitor numbers plummeted from 22,000 in 1993 to 6,000 in 1997. The former capital, Plymouth, which lies adjacent to the volcano, now stands deserted in the island's "exclusion zone". While two-thirds of the 11,500 population left for the United Kingdom or neighbouring Caribbean islands, remaining inhabitants had to be relocated to the previously sparsely populated north of the island. Owing to the mass exodus of educated nationals, there are insufficient human resources at this time to support a growing economy. As such, labour has been imported, some of which was intended to transfer skills and knowledge to local counterparts. Economic losses due to the eruption exceeded the GDP of the island, and post recovery priorities are social and essential services that are for the public good. After a disaster of the scale of that which affected Montserrat, rebuilding an economy is an inevitably slow and costly process.

Despite these tragedies, Montserrat has been afforded the opportunity to redevelop in a sustainable way. Currently, electric generators are dependent on diesel fuel that is imported. Any disruption in supply can leave the country vulnerable. Plans are being developed in renewable energy, fruit and vegetable processing, and volcano-related products, including the manufacture of composite building materials using volcanic ash. The future of energy in Montserrat is geothermal. An assessment of geothermal potential concluded that Montserrat can produce 25 times more than what is needed domestically, thereby affording the possibility of exporting the excess to a regional grid. Wind and solar sources are also feasible, but for local use only.

The main challenge in Montserrat appears to be transportation – at the national and regional levels. Apart from taxis, there is little public transportation in Montserrat. The minibuses do not adhere to any fixed schedule, there are no designated stops and they travel only on the main road. Both minibuses and taxis work mainly during the day and are available very infrequent after formal working hours. Taxis, while providing an on-demand service, find it uneconomical to travel off the existing routes. There is a clear need for a more reliable public transportation system. A demonstration project can be implemented through the mass use of small hybrid cars, but the existing private sector companies that would typically lead such an initiative, are in no financial position to do so.

There has been a decline of almost 80% in tourist arrivals to Montserrat since the ferry service was discontinued in 2005. The main route of access is via a small aircraft from Antigua but this does not have sufficient capacity to transport visitors to allow the tourism industry to thrive. Recently, the Montserrat Tourist Board has been working closely with the Ondeck Group to provide a new product, namely, one-day trips from Antigua on a yacht. The goal is to encourage and increase one-day stays targeting visitors from Antigua as well as international visitors who would have the opportunity of adding on a few days to their vacation in Montserrat. More visitors are still needed on a regular basis for tourism

to make any meaningful impacts on the local economy. One suggestion is to reintroduce the ferry, but operational and upkeep costs (previously subsidised by the British Government) are a prohibitive factor.

Montserrat is building a new capital to replace Plymouth and it will be located in Little Bay located in the northwest of the island. While it is out of the reach of volcanic activity, the area is known to be prone to flooding. In September this year, heavy rains caused the ghaut on the eastern side of a construction site to overflow and flood the new public market. Since the floods, a permanent drain and temporary berms have been put in place to reduce flooding in the area of the public market and the sewage facility. Little Bay, being coastal in nature, could also be adversely impacted by sea level rise. Land erosion is also an issue and this is prevalent on slopes that have been cleared for cultivation.

New industries such as mining and quarrying operations utilising volcanic material have been created. They produce sand and aggregate mostly for export, and manufacture composite slate products from ash. The Government of Montserrat benefits from revenues generated through increased exports from a tax of US\$4 per ton of material exported.

A physical plan is available for the northern section (safe zone) of the island and there are building codes and standards available. The Caribbean Uniform Building Code (CUBiC), and the Eastern Caribbean Codes are used, but there is a Code specific to Montserrat that is in draft form. This is based on the above standards but also addresses risk from seismic activity. This national code is to be ratified in the Legislative Council in due course. Codes and standards are generally enforced quite strongly but the main challenge to enforcement is inadequate staff complement.

Recommendations from EIAs are not implemented adequately as no single agency has accepted the responsibility to regulate certain impacts. An Environmental Management Plan should be mandated as a complement to the EIA and should be introduced through an extensive public awareness programme.

In 2006, the Heads of territories of the Organisation of Eastern Caribbean States (OECS) proposed that Montserrat host a climate change centre for member countries. This climate change centre is expected to work in collaboration with the CCCCC. In February 2009, the Government of Montserrat received the support of Dominica's Prime Minister, Roosevelt Skerritt, for the proposed establishment of the OECS Climate Change Center in Silver Hills in the northern area which is regarded as safe.

The national and sectoral documents that exist do not include climate change considerations. A specialist is needed to revise these documents so that they would better serve Montserrat in the face of changing climate. The OECS Secretariat and the CCCCC can play a role in supporting this. They are already supporting capacity building for climate change through an environmental science course that has been introduced at the UWI Open Campus in Montserrat.

The Ministry of Agriculture has been undertaking some outreach activities in schools to encourage youth to have an interest in agriculture. Other than one school cultivating crops as part of their curriculum, efforts for school leavers to find or create work in the agricultural sector have been largely unsuccessful. The Ministry is also promoting sheltered production (shade houses) as well as food processing, but this is very limited to date.

Solid waste disposal is also an issue on Montserrat. The main landfill site is now in the exclusion zone, and there is a temporary landfill which is poorly managed.

The media has an important role in Montserrat's national development in terms of providing information, creating awareness and reinforcing messages.

2. Country overview

Montserrat is one of the Leeward Islands in the eastern Caribbean, lying 27 miles southwest of Antigua and 40 miles northwest of Guadeloupe. The island is eleven miles long and seven miles wide, entirely volcanic and very mountainous. The coastline is rugged and offers no all-weather harbour, although there are several anchorages in the lee of the island sheltered from the prevailing trade winds. Port facilities exist at Little Bay.

Montserrat is a full member of the CARICOM, and also a member of the OECS and is also an internally self-governing Overseas Territory of the United Kingdom. This provides for the execution of government through a Governor appointed by the Crown, an Executive Council, which has the general control and direction of government, and a Legislative Council. The Governor retains responsibility for internal security (including police), external affairs, defence, heads the public service and offshore finance.

The Soufriere Hills Volcano has been active since 1995, with a fluctuating level of activity. In that time, the activity has produced mainly pyroclastic flows on the eastern and western flanks of the volcano. An area around the volcano, approximately two-thirds of the island, has been designated a Special Vulnerable Area and two areas around the coastline have been designated as Maritime Exclusion Zones. Between them, these cover all the areas that have been affected by pyroclastic flows or are likely to be affected.

The most recent activity was on Monday 28 July 2008 when, in a period of less than one hour, the volcano erupted, generating an ash cloud that rose to approximately 12.192 m above sea level. It also generated a number of pyroclastic flows on the flanks of the volcano, all of which were in the Special Vulnerable Area. Small pumic pallistics fell in some inhabited areas on the margin of the Special Vulnerable Area.

A new Hazard Level System was introduced in August 2008. The Hazard Level System divides the southern two-thirds of Montserrat, the Special Vulnerable Area, into six zones with two Maritime Exclusion Zones. Access permission for each of these zones is dependent on the Hazard Level. The current Hazard Level is 3, on an increasing scale of 1 to 5.

3. Overview of Montserrat's participation in international and regional climate change responses

Montserrat, as a developing Overseas Territory of the United Kingdom, is not party to the UNFCCC or the Kyoto Protocol. However, the United Kingdom Government is in the process of extending its ratifications of the UNFCCC and the Kyoto Protocol to a number of its Overseas Territories and Crown Dependencies. Of the Overseas Territories, Bermuda, the Cayman Islands, the Falkland Islands and Montserrat have indicated that they wish to be associated with United Kingdom ratifications.

Although Montserrat is a member of CARICOM, it did not participate in the earlier regional climate change initiatives.³⁴ However, Montserrat will be participating in the "Enhancing Capacity for Adaptation to Climate Change in the Caribbean (ECACC) UK Overseas Territories" project from January 2009, as an extension of the MACC project being implemented by the CCCCC. Expected outputs for Montserrat and the other Overseas Territories include:

- Formalization of local arrangements to facilitate implementation

³⁴ CPACC, ACCC

- Establishment of Climate Change Focal Points and National Implementation Coordinating Units (NICUs): These will provide the interface between the regional implementation mechanism and the local implementing agency
- Training in vulnerability assessments: Under the MACC project, a common methodology for carrying out these assessments is being developed and territory teams will be trained in the use of the methodology
- PEO: Under the ACCC programme, a regional PEO strategy has been developed and will be implemented in the Overseas Territories. The territories, through their NICUs, would access material developed for the purpose of promoting a local PEO exercise
- Development and implementation of national climate change strategies: Country climate change policies and implementation strategies were developed under CPACC, and can be facilitated in the Overseas Territories using regional expertise that was developed in the process. Under ECACC, a regional strategy will be developed through a process of wide consultation with all Caribbean Overseas Territories
- Development of the capability to address climate change issues through human resources development and other institutional strengthening: This can be accomplished through participation in regional workshops aimed at capacity building in areas such as, economic valuation, incorporating climate hazards in EIAs, adaptive risk management approaches to dealing with climate, participating in the Master of Science programme at UWI, Barbados
- Establish linkages with, and participation in, planning for Adaptation to Climate Change projects to determine lessons learnt from pilot projects and to facilitate application of findings within the national context.

4. Institutional framework to address climate change

Table 12 shows the institutional structure that currently governs climate change responses in Montserrat.

Table 12
Institutions in Montserrat with responsibilities linked to climate change.

Agency	Responsibility	Scope
Department of Environment (Ministry of Agriculture, Lands, Housing and the Environment)	Likely to be the climate change focal point institution under the ECACC project.	National
Physical Planning Unit	Physical planning, building codes, zoning	National
Department of Agriculture (Ministry of Agriculture, Lands, Housing and the Environment)	Agriculture, fisheries	National
Caribbean Community Climate Change Centre (CCCCC)	The Caribbean Community Climate Change Centre coordinates the Caribbean region's response to climate change. Officially opened in August 2005, the Centre is the key node for information on climate change issues and on the region's response to managing and adapting to climate change in the Caribbean. It is the official repository and clearing house for regional climate change data, providing climate change-related policy advice and guidelines to the Caribbean Community (CARICOM) Member States through the CARICOM Secretariat. In this role, the Centre is	Regional (CARICOM, UKOTs, Cuba)

Agency	Responsibility	Scope
	recognised by the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Environment Programme (UNEP), and other international agencies as the focal point for climate change issues in the Caribbean. It has also been recognised by the United Nations Institute for Training and Research (UNITAR) as a Centre of excellence, one of an elite few.	
OECS-ESDU	The Environment and Sustainable Development Unit of the Organisation of Eastern Caribbean States (OECS-ESDU), is the entity within the OECS Secretariat that is responsible for the provision of natural resource and environmental management services to the member states of the OECS. The mandate of the OECS-ESDU is to assist member states in all matters pertaining to the sustainable use of natural resources to ensure the sustainability of livelihoods of the peoples of the OECS.	Regional (OECS)
Proposed OECS Climate Change Centre	Work in collaboration with the CCCCC, as well as provide education and outreach on climate change and renewable energy, raise awareness and motivate Caribbean nationals to develop and assist with the implementation of climate change and energy efficiency initiatives.	Regional (OECS)

5. Legislative and policy framework to address climate change

There is no legislation that specifically addresses climate change. However, there is legislation related to environmental protection and disaster risk reduction.

(a) Conservation and Environmental Management Act, 2008

As part of the ongoing outreach and consultative exercise for the new proposed environmental bill, a leaflet has been published to give a brief overview of the bill and its expected achievements. The legislative review has been ongoing for over a year, and key inputs from major stakeholders have been considered. The Conservation and Environmental management Act aims to consolidate existing pieces of environmental legislation, consider recent research findings related to ecological and socioeconomic values of the environment, and modernise the legislation to conform to internationally accepted standards.

(b) National Environmental Action Plan, 1994

The National Environmental Action Plan assesses the key environmental problems facing Montserrat, and devises policies to manage the country's natural and cultural resources better. It has been produced as part of a regional initiative to improve national environmental planning and regional donor coordination resulting from the June 1992 meeting of the Caribbean Group for Cooperation in Economic Development (CGCED).

(c) Montserrat Environment Charter

On 26 September 2001, Montserrat signed the Environment Charter with the United Kingdom Government signing a reciprocal agreement at the same time.

(d) Country Policy Plan 2004/5-2006/7

Initiation of a comprehensive Environmental Health Promotion and Protection programme to focus on community involvement, by improving monitoring and public education and communication between the responsible government department and the public, and the reviewing of legislation regarding solid waste disposal.

Additional relevant legislation includes:

- Forestry and Wildlife Ordinance, 1987 (reviewed 2000, 2006)
- Fisheries Act 1972
- Turtles Ordinance Cap: 112, 1951
- Montserrat Physical Planning Act, 2003
- Montserrat Physical Plan, 1995
- Endangered Animals and Plants Act, 2002

(e) National policy, strategy and legislation addressing disaster risk reduction

There is a national policy and strategy which forms part of, and are included in the Government of Montserrat Corporate Plan 2003-2006, and in the Montserrat Sustainable Development Plan 2003-2006.

- Disaster Response Act No.10 of 1999: All development projects take into account disaster risk reduction as a matter of critical importance. All development projects have to include EIAs, part of which is a natural hazard impact assessment. This must be included for the project to be approved. This is routinely enforced through the various government departments.

(f) Sector plans or initiatives that incorporate disaster reduction concepts into each respective development area (such as water resource management, poverty alleviation, climate change adaptation, education and development planning)

- The Montserrat Corporate Plan 2003-2006 for example, includes provisions addressing sustainable environment and disaster management, economic growth and financial stability, social development and quality of life
- Other plans exist in the health, water and education sectors
- There is also a Participatory Poverty & Hardship Assessment of Montserrat Plan 2000. One of the most successful initiatives incorporating disaster risk reduction concepts is the Ash Clearing Assistance Project to clean up after the volcanic dome collapse disaster event of July 2003. This initiative focused on reducing health hazards in the environment and air pollution.

(g) Building codes of practice and standards which take into account seismic risk

The Caribbean Code CUBiC and the Eastern Caribbean Codes are used. In addition there is a code specific to Montserrat that is in draft. This is based on the above standards and codes and addresses the risk of seismic activity. This national code will be ratified in the Legislative Council in the near future. Codes and Standards are generally enforced quite strongly, but the main challenge to such enforcement is inadequate numbers of staff.

6. Key sectors

The sectors and systems identified as most vulnerable are listed below.

- Transportation
- Tourism
- Human settlements and infrastructure
- Health (and nutrition)
- Agriculture.

7. Overview of research and studies on climate change

Vulnerability assessment work in Montserrat has been in relation to seismic activity – both on the island, as well as from underwater volcanoes in the Caribbean Sea. However, climate change has gained some attention in recent years and Montserrat will participate in the ECACC project. One related study is described below.

(a) A Study of damage to Beaches following extreme weather event on the coastline of Montserrat

This study examines beach erosion as a result of rough seas in Montserrat (March 2008), due to a cold front along the coastline of the northern Caribbean islands. The marine environment continues to play an important part in the economy of the island, providing full-time, part-time and seasonal employment, and contributing significantly to domestic food security and national GDP. Some of Montserrat's most important resources, especially in terms of commerce are its port facilities. Other major uses of beaches include tourism, recreation, as fish landing sites, a source of fine aggregates used in the construction industry, and habitats for nesting turtles and other animals and plants. Beach erosion affects the sustainability of the tourism industry and the livelihoods of small business operators. Study areas include five sites from Little Bay to Isles Bay. A very brief preliminary examination of the beaches mentioned above indicates that the need also exists for development of an integrated perspective that takes into account other elements of vulnerability such as economic, environmental and institutional, that will also affect the extent of vulnerability of our beaches to climate change.

8. Other initiatives relevant to climate change

(a) The Montserrat Environmental Education Project

A National Environmental Education Committee is overseeing the Montserrat Environmental Education Project, while two subcommittees, one on waste management and the other on biodiversity, have been established to manage priority activities.

(b) The Centre Hills Project

This project was launched in June 2005. It aims to enable the people of Montserrat to conserve the Centre Hills. Since volcanic activity has devastated most of the southern forests and mountains, the Centre Hills has become the last remaining habitat for numerous threatened species. These include the Montserrat oriole, "mountain chicken" frog, galliwasp lizard, and the endemic Montserrat orchid.

(c) Economic valuation of the Centre Hills

The economic valuation of natural resources in Montserrat is a critical component in efforts to plan for the sustainable use and management of the natural environment. The project's goal is to inform policy-makers about the value of these resources, along with the costs and benefits of various management and use scenarios, in order to support sustainable human activity and livelihoods. The project seeks to:

- Value ecosystem goods and services of the Centre Hills
- Determine the impacts of different development scenarios in Montserrat on the values of these goods and services to livelihoods
- Communicate the results of the economic valuation to policy-makers to inform policy decisions
- Provide economic valuation data to inform the development of sustainable financing systems for conservation in Montserrat, which is of key concern to the emerging management plan for the Centre Hills.

The project's focus is primarily on the Centre Hills as the last remaining significant forest resource on the island, but it must address the larger institutional and natural resource management context, needs, and priorities for the entire island.

(d) Linking risk reduction and environmental management:

- Ash Cleaning Assistance Programme: This was undertaken to reduce health risks by removing volcanic ash from occupied areas to an exclusion zone, and stabilising it to prevent air pollution
- Watershed and Reforestation Management Programme: This was led by the Ministry of Agriculture to protect water spring catchments that provide the only source of potable water to the population of Montserrat
- Wetland Project: This project has declared a specific at risk area, "Piper's Pond", as a protected area to protect a mangrove swamp and endangered species of that area
- Protected forests: In Montserrat, zones above a certain elevation are protected. No cutting of forests or other removal of vegetation is allowed.

(e) Use of financial instruments as a measure to reduce the impact of disasters:

Insurance is the most commonly used instrument to influence a hazard resistant culture. This includes insurance/reinsurance, calamity funds, catastrophe bonds, micro-credit finance, and community funds among others. Incentives are usually offered through reduced premiums for disaster resistant construction. Private insurance companies manage this. Additionally, government, by law, votes annually on contingency funds. This is under the management of the Ministry of Finance.

9. Relevant data on Montserrat

(a) Meteorological data

Gerald's Airport Meteorological Office, the Disaster Management Coordination Agency, possesses meteorological data.

(b) Coral reef data

In 1995 and 1996, Sustainable Ecosystems Institute carried out a series of studies to document the biological diversity of Montserrat's coral reefs. The goal of the study was to document the reef patterns with a view to marine park development. This was one of the first scientific studies carried out on the reefs. The Institute used a range of scientific methods to survey the reefs. Sessile species such as corals, sponges, and marine plants were surveyed using photo-quadrat analysis. In addition, during 1995 and 1996 a series of permanent quadrats were established at selected sites. Mobile invertebrates (e.g. crabs, starfish.) were recorded using 10m transects. Fish abundance and diversity were estimated using 20m visual transects. The commencement of the study coincided with the beginning of the Soufriere Hills volcanic eruption, and sediment from this eruption fell onto the reefs. To measure sediment levels on the reefs, sediment depth was recorded and a series of underwater sediment traps were set. Water clarity and turbidity were estimated using secchi disks and aerial surveys of the reefs were conducted. The study also estimated rate of sediment input to reefs from volcanic origin, and conducted surveys of affected reefs to document changes in the health of the reef system. This study provides a baseline study for future comparisons.

In 2005, the first Reef Check survey ever conducted on the island was completed and a long-term reef monitoring programme for the country was established. Reef Check is a community-based monitoring protocol, designed to measure the health of coral reefs on a global scale. Local dive shops are involved in the monitoring programme, which is still ongoing.

(c) Socio-economic data

These are available from the Statistics Department, Ministry of Finance and Economic Development.

(d) Environmental monitoring at the Montserrat Volcano Observatory

The environmental effects of the eruption have been routinely monitored since onset. This has included the measurements of ambient sulphur dioxide (SO₂) concentrations at ground level, the monitoring of fine dust particles in the air, and the measurement of the pH of rainwater.

Diffusion tubes positioned at various sites beneath the volcanic plume on the northwest and west of the volcano measure the concentration of SO₂ at ground level. Only once (during 1998) has the concentration of SO₂ increased above the WHO safety guidelines for people working and living in this area.

The pH of rainwater is monitored beneath the plume and is often as low as about 2 directly downwind of the volcano. This leads to the rapid corrosion of metal structures and cars left in the exclusion zone.

(e) Topographical data

The Physical Planning Unit, in collaboration with the Department of Lands and Survey and United Nations Volunteers programme, have been developing a Geographic Information Systems (GIS)-based Land Information System (LIS) for effective planning and better management of land resources. This GIS/LIS system will also provide bases for the development of a National Data Warehouse, which could effectively be utilised for better management of various public utility services and other resources of the country. The proposed National Data Warehouse will also provide support in economic development and social stability of Montserrat.

10. Needs and gaps

(a) Land-use zoning

As a result of Montserrat's circumstances, nearly 5,000 people live on 13 square miles of land. This has led to the uncontrolled conversion of agricultural land for residential or commercial development.

(b) Technical capacity

Capacity building at the national level is greatly needed to assess the impacts of climate change on the coastal resources and by extension, on the societies and economies of the country. The capacity to guide the integration of climate change into national planning is also needed.

(c) Impact studies

This is needed for the whole island as well as its socio-economic sectors.

11. Conclusion and recommendations

Montserrat has an extensive and well – established disaster management framework as it relates to the volcano, for:

- Vulnerability studies (including hazard mapping)
- Information sharing and dissemination
- Public awareness
- Early warning systems
- Financial incentives
- Contingency planning at both national and community levels
- Emergency funding (by law, government votes for contingency funding annually)
- National and community storage facilities for emergency relief items – mainly food, medicine and tents/shelters.

With the imminent establishment of a multi-sectoral National Climate Change Committee, these mechanisms can be used to build awareness of climate change as well as mainstream climate change matters into sectoral and disaster reduction planning. This approach is highly recommended as the population is very small and technical personnel are limited.

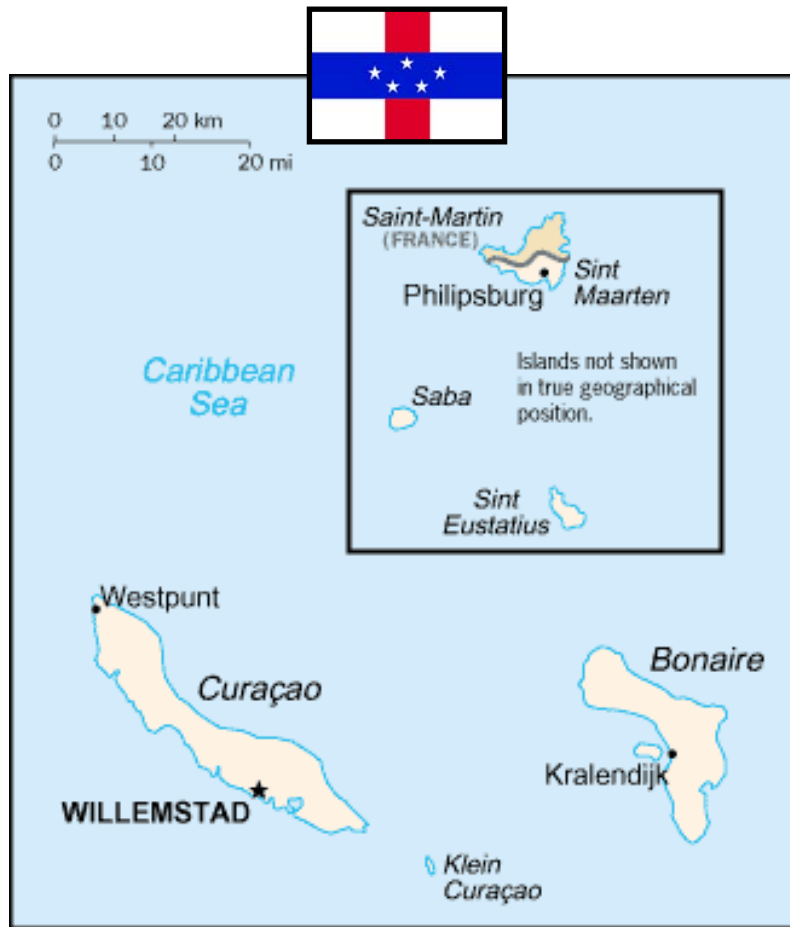
While policy guidance may be needed to better adapt to climate change, the country's unique circumstances must be taken into consideration. Many skilled persons have emigrated, thereby reducing the technical capacity to address climate change responses. Furthermore, many ecological systems have been destroyed or severely damaged, so what remains must be protected as Montserrat is rebuilding its economy and social services.

Mechanisms must be put in place to ensure that development is not approved in order to “fast-track” economic growth, but rather to ensure that it is consistent with Montserrat's vision of sustainable development.

Table 13
List of participants at the consultations in Montserrat

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NETHERLANDS ANTILLES



Source: http://www.appliedlanguage.com/maps_of_the_world/map_of_netherlands_antilles.shtml

G. NETHERLANDS ANTILLES

1. Introduction and brief summary of the discussions

Meetings with stakeholders took place on 10 October 2008 at the Headquarters of the Central and Island Government in Curaçao. The Prime Minister of the Netherlands Antilles, Ms. Emily de Jongh-Elhage, gave opening remarks and she agreed to act as a champion for climate change in that country.³⁵ ECLAC delivered presentations on each of the Stern Review, the RECC and adaptation to climate change in the Caribbean.

There are no existing policies that include climate change, and it was suggested that any such policies should be structured to take into account climate projections for the next 50 years. The Netherlands Antilles had not previously participated in any regional climate change initiatives. The only related research has been on climate change impacts on turtle populations. There is an active turtle monitoring programme in the Netherlands Antilles which is in accordance with obligations under the Convention on International Trade of Endangered Species (CITES).

The two major power generation methods in Curaçao are oil-fired steam turbines and diesel engines using heavy fuel oil. All plants together have a capacity of 118 MW peak load. The base load is about 80 MW. The total annually generated power amounts to 700 GWh. The consumers' electricity price is graduating to \$0.35/KWh for the access use of 300 KWh/month. Currently more than half the costs of the utility are fuel costs. The annual fuel purchases of the company are in excess of US\$150.000.000.

There are successful solar and wind projects in Curaçao. The country has been utilising wind energy for electricity generation since 1993. Even though wind turbines can be erected for personal use, the excess electricity cannot be connected to the national grid. The first wind park is located at "Tera Korá", and has a 3 MW peak power in total. The second wind park was established in 2000 at "Playa Kanoa" and is rated 9 MW peak output. The latter is likely to be expanded.

There is no national renewable energy policy but Aqualectra, the island's sole electricity and water supply company, has its own plans to include renewable sources in the energy mix. The island needs a national policy that promotes the best use and lowest cost of energy. The policy must also have associated legislation that must be enforced. Lack of enforcement is currently a problem in Curaçao, particularly regarding building and mandatory measures may be needed.

A small percentage of the population illegally uses electricity from the grid. This may indicate that some people cannot afford the current electricity cost, and may present an opportunity to further explore alternative and cheaper means of generation in order to pass savings onto consumers.

Efforts to get seawater air conditioning in Curaçao started in 2000. The effort is now in its later stages and actual building of the pipeline and required infrastructure will begin in the last quarter of 2008, with expected project completion during the summer of 2009. The seawater air conditioning system operates with a temperature differential between the water it takes in and the water it lets out of about 7°C, and the return water will go into the sea again at 100 meters depth to avoid any substantial environmental impact. The customers for the system are the Marriott Hotel, Hilton Hotel, Holiday Beach Hotel, Clarion Hotels, as well as the World Trade Center and the Aqualectra (local power and water company) head office.

³⁵ This is the UNFCCC focal point Ministry for Climate Change.

There is a computer programme available to conduct energy audits and this generates information on the efficiency with which electricity is being used, the breakdown of the costs and identifies the potential for energy savings. There has been a broad national awareness campaign to use compact, fluorescent, energy-saving light bulbs. They are cheaper than when first introduced on the market, offered in a variety of colours, and are widely available. They also showed a cost saving in the long term and this has resulted in the increase in sales of such items. This consumer decision to switch to fluorescent bulbs was driven more by economics than environmental consciousness.

There is some level of awareness about climate change among the technocrats who are usually at the front lines at forums to discuss environmental issues. However, they can only report little progress by policymakers to effect change. As such, policymakers are the key target audience for climate change outreach.

School children were also identified as a key audience. One way to ensure they are made aware of environmental and climate change issues is to mandate ecology and climate change components on the curriculum.

The annual “Walk and Run” event is typically used as an outreach mechanism to engage the 3,000 participants. In March 2008, three persons from Curaçao’s Amigu di Tera (Friends of the Earth) joined “Expedition 2041 to the Antarctic” to learn more about global warming and its consequences. In fact, a beach improvement and fisheries management programme which takes into account sea level rise, is being developed. There is no national coastal zone management plan, but marine parks have their own management plans.

It is perceived that there is little concern for vulnerable housing communities. Initiatives specifically for informing and empowering communities are needed. The Netherlands supports many of Curaçao’s macro-level socio-economic initiatives. However, sustainable development or climate change responses have not yet been proposed by policymakers.

2. Country overview

Curaçao is the largest of the five islands of the Netherlands Antilles in the Caribbean. It is located 40 miles off the coast of Venezuela, 42 miles east of Aruba, and 30 miles west of Bonaire. Curaçao is the largest of the five islands and the government of the Netherlands Antilles is located here. The island has an area of 171 square miles (about 62 km long and 14 km wide) (4 km at its narrowest point in the middle of the island). About 150,000 people live on the island. The local language is Papiamentu (or Papiamento), the official language is Dutch, and English and Spanish are widely spoken.

One feature that distinguishes Curaçao from its neighbours is its irregular coastline, which allowed for the development of excellent natural harbors. The capital city of Willemstad on the island’s southern coast is a vibrant port city that is a stopping point for the shipment of crude oil from Venezuela. In addition, Curaçao lies completely below the Caribbean hurricane belt but its coastline is vulnerable to sea level rise and storm surges as it is less than 1 m above sea level and 40% of the workforce occupies the coastal region.

Under a new political structure, agreed between the islands’ leaders and the Dutch government in late 2005, the Federation will be dissolved in December 2008. Curaçao and Sint Maarten will become autonomous territories of the Netherlands. The less-populated islands of Bonaire, Saint Eustatius and Saba will be given city status within the Netherlands.

The changes follow referenda in which Curaçao, Bonaire, Sint Maarten and Saba opted to break free from the Federation, Saint Eustatius supported the *status quo*, while none of the islands opted for independence. Because of the inextricable dependence of tourism on the natural environment, the island Governments have determined that the tourism industry must be developed within a sustainable context. Most of the policy review work and progressive initiatives have occurred in the tourism sector, as well as in the coastal and marine environment.

A large percentage of the food in Curaçao is imported as a result of a lack of fresh water on the island. Dams are used to trap rainwater but this is not allowed to infiltrate into the ground. The island has no permanent freshwater streams, but is traversed by many intermittent streams that carry rainwater to the sea. There are also upwards of 1000 agricultural water catchment dams.

Curaçao's residents perceive that the political will to better institute more sustainable practices is weak, partially as a direct result of the frequent change of Governors in that country.

3. Overview of participation of the Netherlands Antilles in the international and regional climate change responses

Curaçao is not party to the UNFCCC and is not obligated to meet any of the commitments under this treaty but the country is in the process of creating legislation that would comply with the Kyoto Protocol.

Other Multilateral Environmental Agreements (MEAs) to which the Netherlands Antilles is Party include:

- Cartagena Convention
- Protocol Concerning Cooperation in Combating Oil Spills in the Wider Caribbean Region
- Specially Protected Areas and Wildlife (SPA) Protocol
- Ramsar Convention
- The London Convention
- International Convention for the Prevention of Pollution from Ships(MARPOL)
- CITES
- The Inter-American Convention for the Protection and Conservation of Sea Turtles
- CBD.

4. Institutional framework to address climate change

Arising from the small populations and the lack of capacity, important roles are played by non-governmental organizations and other CBOs in the management of natural resources, public education, and implementation of commitments under the MEAs. Thus, non-governmental organizations regularly interact with Government and wide-ranging exchanges of information, both formal and informal, take place, especially through the National Nature Forum where the government meets with non-governmental organizations at least once every two years to address themes related to nature, to seek funding, and to advance cooperation.

Table 14 shows the institutional structure that currently participates in climate change responses in the Netherlands Antilles.

Table 14
Institutions in the Netherlands Antilles with responsibilities linked to climate change

Agency	Responsibility	Scope
Public Health, Department of Environment and Nature Conservation	Portfolios related to Sustainable Development and Environment. In this regard, it is responsible, as directed by the Central Government, for the implementation of the Multilateral Environmental Agreements (MEAs) to which the country is party.	National
Department of Agriculture, Livestock and Fisheries (DLVV)	Focusing on water supply for food production	National
Amigu di Tera (Friends of the Earth – FoE, Curaçao)	FoE focuses on environmental problems that transcend political and geographical borders and co-operates with other organisations, in addressing sustainable development matters.	NGO / National
Caribbean Research and Management of Biodiversity (CARMABI)	The island government mandated the CARMABI initiative with a broad conservation oriented research programme, to emphasise research on terrestrial natural science. This research made a critical contribution, among others, towards the development of an insular land-use plan by the government of Curaçao. The plan came into legal effect in 1997 and is known as the EOP (eilandelijk ontwikkelings plan or “island development plan”). In this plan many areas of the island that merit preservation are afforded legal status as conservation and park lands.	National
Natuur & Milieucentrum; Curaçao	This initiative seeks the interest of the flora and fauna of the country.	National
Reef Care; Curaçao	Reef Care Curaçao protects and preserves the coral reef as part of a worldwide effort.	National/ International
Netherlands Antilles Coral Reef Initiative (NACRI)	The NACRI brings together a broad range of organizations and groups: nature conservation organizations that manage the marine parks of the islands, government agencies involved with nature conservation, research institutes, non-governmental pressure groups concerned about coral reefs, and also businesses that exist through the presence of the coral reefs and their branch organizations, such as the Curaçao Dive Operators’ Association (CDOA) and the Bonairean Council of Underwater Resort Operators (CURO).	National
Department of Environment and Nature (MINA)	As a department of the central (or federal) government encompassing all five islands of the Netherlands Antilles. MINA’s tasks are set out in the Netherlands Antilles Island Regulation (ERNA, 1998, article 2.e.10) as follows; “environmental and nature management and conservation as they derive from treaties”. In other words, MINA translates the requirements and obligations flowing from multilateral environmental agreements to the local Antillean situation, specifying them in national legislation and policy that provides the framework by which the islands are bound, but within which they are free to set their own regulations and policies.	Regional – Dutch Caribbean

Agency	Responsibility	Scope
Dutch Caribbean Nature Alliance	“To safeguard the biodiversity and promote the sustainable management of the natural resources of the islands of the Dutch Caribbean, both on land and in the water, for the benefit of present and future generations, by supporting and assisting the protected area management organisations and nature conservation activities in the Dutch Caribbean”	Regional – Dutch Caribbean
Netherlands Antilles National Park Foundation (STINAPA)	Stichting Nationale Parken Bonaire (STINAPA Bonaire) is a non-governmental, not for profit foundation commissioned by the island government to manage the two protected areas of Bonaire: the Bonaire National Marine Park (BNMP – www.bmp.org) and the Washington Slagbaai National Park (WSNP – www.washingtonparkbonaire.org).	National
Central Government (Disaster Management)	The Central Government has a model for administration of disaster preparedness in all islands. Each island has a Lieutenant-Governor, with the office of the Prime Minister having overall responsibility for these local units. There is an overall disaster co-ordinator for the entire Netherlands Antilles, as well as a Disaster Foundation, which is supported by the Government and undertakes disaster mitigation. In the event of a disaster, the Foundation’s personnel are supervised by the overall co-ordinator, and not the line Minister. However, in the day-to-day context, the co-ordinator reports to the Minister of the Interior. The Lieutenant Governors preside over the Executive Boards of the Island Councils. In the event of a disaster, the Fire Chief takes the operational lead. Although each island has an island co-ordinator, the overall disaster co-ordinator for the Netherlands Antilles intervenes only as requested. Even so, only in the event of evacuation or the transport of persons to other islands, is the disaster coordinator mandated to get involved.	National

5. Legislative and policy framework to address climate change

(a) Environmental Legislation (Nature and Environment Policy Plan for the Netherlands Antilles)

Environmental management in the Netherlands Antilles is supported by the Nature and Environment Policy Plan (NEPP) and outlines environmental issues of concern to all the islands, identifying those which can be addressed at the local and central levels.

The NEPP provides the framework for environmental and nature conservation policy for the coming years. The priority activities are determined by the:

- Degree of endangerment to a sustainable future
- Level of threat to the environment
- Relation to and synergy with the economy

- Commonality (i.e. experienced by all five islands of the Netherlands Antilles) of the environmental issues.

The objectives of the NEPP are to address the problems and challenges relating to:

- National environmental exploration
- Waste and waste water
- Oil refinery, oil trans-shipment and the environment
- Sustainable tourism development
- Nature conservation
- Increasing public support for environmental care and nature conservation
- Sustainable energy.

(b) Energy Legislation

A national energy policy has been drafted. However, Aqualectra has developed its own energy policy which includes renewable energy technology.

(c) Protected Areas Legislation

Protected areas legislation for the Central Government of the Netherlands Antilles exists.

(d) Tourism Legislation

The Sustainable Tourism Policy (1997) measures include:

- An “Island Law” for sustainable tourism in the Netherlands Antilles
- Adequate spatial development legislation
- Legislation for environmental permitting and EIAs
- Legal frameworks for the protection of terrestrial nature and marine areas
- Financial stimuli for tourism companies making environment-improving investments
- Laws with standard environmental requirements for hotels.

(e) Reef Management Ordinance, Curaçao (1976) No. 48

The Reef Management Ordinance prohibits spear fishing and breaking corals. It also provides for resolutions to further protect the environment.

(f) Island Ordinance on Nature Reserves

The Island Ordinance on Nature Reserves is a framework for the designation of areas on land or underwater as parks or protected areas.

(g) General Environmental Ordinance

Based on the National Environment Ordinance, the central government’s task is to draw up a national environmental policy plan and to develop environmental standards; to implement obligations

resulting from conventions and other international agreements; and to establish an Environmental Inspectorate.

The National Environment Ordinance also implements several Conventions to which the Netherlands Antilles is party, or which it intends to ratify. These are:

- The Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (the Cartagena Convention, Trb. 1983, 152), which aims to protect and develop the marine environment of the Wider Caribbean region. The Convention is a framework within which specified protocols are developed for an effective implementation
- The Protocol concerning cooperation in combating oil spills in the wider Caribbean region (Oil Spill Protocol), which is the first protocol to the Cartagena Convention
- The Protocol on Land-Based Sources of Marine Pollution (LBS Protocol), the third protocol to the Cartagena Convention aims to prevent, reduce and control pollution of the marine environment by land-based sources and activities
- The Basel Convention (Trb. 1990, 12), which aims to reduce and control the trans-boundary movement and disposal of hazardous waste
- The Rotterdam Convention (Trb. 1999, 30), which regulates international trade of hazardous substances and more specifically the exchange of information between exporting and importing countries, addresses a “prior informed consent” procedure (PIC)
- The Convention to protect the Ozone Layer (Trb. 1985, 144; 1988, 145), a framework convention to protect the ozone layer
- The Montreal Protocol (Trb. 1988, 11; 1989, 11; 1990, 99; 1991, 49), is a protocol under the Ozone Convention above, intended to reduce the release and the production of substances that damage the ozone layer, such as Chlorofluorocarbon gases or CFCs
- The United Nations Framework Convention on Climate Change (Trb. 1992, 189; 1994, 187; 1996, 85). This Convention strives for measures to reduce climate change, i.e. to reduce greenhouse gases such as carbon dioxide or CO₂.

Maritime conventions, such as the London Convention 1972 (Trb. 1973, 172) and the International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC) (Trb. 1992, 1); and agreements under the International Maritime Organization (IMO), such as MARPOL, are not included in this Framework Ordinance because these Conventions are considered as maritime conventions with an environmental aspect, and are therefore implemented by maritime ordinances, such as the National Oil Tanker Damage Ordinance, the National Oil Tanker Liability Ordinance, and the National Ordinance to Prevent Pollution from Ships.

(h) Building codes

Building codes have long been established in the Netherlands Antilles and are still being strengthened.

6. Key sectors

The sectors and systems identified as most vulnerable are listed below:

- Tourism
- Coastal zone

- Human health
- Biodiversity
- Water and Energy.

7. Overview of research and studies on climate change

There is very little work carried out in relation to climate change impacts on the Netherlands Antilles specifically. Much of the literature refers to impacts on Caribbean small island developing states. However, in 2004, students³⁶ at the University of Michigan conducted a study on “Mitigating the Effects of Global Warming in the Netherlands Antilles Islands’ Coral Reef Ecosystems”. The study examines the current vulnerability of Curacao’s coral reefs as a result of anthropogenic influences, which make them less likely to recover from bleaching events caused by climate change. The study also proposes a policy plan, with both a national and international approach, for mitigating these adverse effects. Components of the national module of the plan are:

- Expansion of the Curacao Underwater Park, which is a protected area
- Curbing coastal development
- Sewage treatment systems
- Sustainable fishing practices
- Education.

The “Global” approach includes:

- Reduction in greenhouse gas and CFC emissions by the Netherlands Antilles;
- Obtaining global recognition of the problems faced by the small island countries;
- Increased collaboration within and between Small Island States;
- Profiting from preservation.

8. Other initiatives relevant to climate change

(a) Electricity supply and demand

Aqualectra, Curacao’s water and electricity supply company, was the first to achieve ISO14001 certification and is audited twice a year. This company has plans to increase the proportion of renewable energy in its mix over time. This vision is expressed in its Utility Plan 2020, which provides for the establishment of strategic frameworks in which the supply of water and electricity is addressed for the coming 20 years. It contains a visionary aspect on the basis of which a glance is cast into the future to project the water and electricity supply for the next 20 years. After all, the necessary infrastructure investments of today have a range of somewhere between 15 and 25 years. It also details when certain investments have to take place in order to guarantee the water and electricity supply. In terms of the employment of renewable sources of energy, it has been proven that wind energy is more competitive than solar at this time. Currently, the installed capacity of wind power compared to peak load is 10%, and Aqualectra is hoping to increase this to 20% in 2 years, and 30% by 2015 (approx. 40 MW). There are also plans to install cool-pipe systems in hotels for cooling rather than using electricity for air conditioning. To supply the total population of 150,000 inhabitants with utilities, there is an extensive

³⁶ Simon, David and Brody Webster. 2004 <http://www.globalchange.umich.edu/globalchange3/current/workspace/a/>

infrastructure spread over the island with over 60,000 connections for water and about 64,000 connections for electricity.

(b) Energy auditing

There is a computer programme available for households and businesses to conduct an energy audit.

(c) Biofuels

There is a project being prepared to develop algal farms as the feedstock for biodiesel production. The cool (16°C) run-off from air conditioning units will be used as the feedstock for algal growth.

(d) Public awareness

A leaflet on the modalities of constructing an energy efficient home has been prepared and distributed in Dutch and Papiamentu. Another has also been prepared on wind energy. A number of environmental awareness programmes are being conducted in primary schools to address issues such as waste and its prevention. In several secondary schools, the international programme “Globe” has been introduced connecting schoolchildren from the Netherlands Antilles to other children all over the world through the Internet, for the purpose of exchanging environmental information. General environmental education is provided by a Commissioner of Education, with significant assistance from non-governmental organizations. Non-governmental organizations also conduct environmental awareness initiatives which the Government may assist through funding as well as with content.

(e) Waste management

A survey conducted throughout the islands revealed the existence of a number of initiatives in the fields of recycling and reuse, which contributed to a decrease in the volume of wastes. The survey also noted that focused assistance from the Government in this area, would result in a much healthier environment. In Curaçao, treatment plants are available for coastal and inner-city sewage disposal. Some sewage contaminated water reaches the near-shore marine environment. However, work is in progress to connect all areas to the treatment plants. In the capital, Willemstad, the downtown grey water is subjected to secondary treatment while other grey water is directed to septic tanks. Contamination of the water table is not an issue in Curaçao, since the water used for drinking is obtained through desalination. A total of 30% of the households in Curaçao are connected to a sewage treatment system, and of that, 60% is being recycled for irrigation purposes (golf courses and agriculture) at tourism facilities.

9. Relevant data on the Netherlands Antilles

(a) Meteorological data

- The Meteorological Services of the Netherlands Antilles and Aruba (<http://www.weather.an/>), based in Curaçao is the central data repository for climate data. These datasets include temperature and rainfall, and wind, but not sea level.

(b) Comprehensive socio-economic data

- United Nations statistical website (<http://unstats.un.org/unsd/default.htm>)
- Curacao’s Central Bureau of Statistics (CBS – <http://central-bureau-of-statistics.an/organisation.asp>) is a governmental organization with head office in Curacao, and branch offices in Bonaire and Sint Maarten. It was founded as a separate Bureau in 1976.

At this moment the CBS is part of the Ministry of Economic and Social Affairs. It serves all the islands of the Netherlands Antilles – Bonaire, Curacao, Sint Maarten, Sint Eustatius and Saba.

10. Needs and gaps

(a) More awareness and investment in renewable energy technology

The technology is already available for solar-powered air conditioning.

(b) National Energy Policy

The National Energy Policy should have strong guidance on renewable energy technology and its role in climate change mitigation. There also needs to be a significant public awareness component of the policy.

(c) More resilient buildings

The agency that manages the Housing Fund for post disaster reconstruction can build awareness by constructing more resilient and more environmentally conscious buildings.

(d) Awareness at the policymaking level

Economic impacts of climate change need to be presented to policymakers so that they make better informed decisions.

(e) Implementation and enforcement of policies that help protect the environment

In doing this, natural systems become more resilient to climate change impacts

(f) Impacts studies and scenarios

Impacts studies are necessary as a basis to initiate public awareness campaigns with facts, figures (what can be lost), savings and costs.

11. Conclusion and recommendations

Public participation is still weak and there is need for awareness-building and perhaps a change in the manner in which information is disseminated. Nevertheless, there is active participation among some non-governmental organizations. As with Aruba, there is an opportunity for the development of a climate change agenda for the Netherlands Antilles, and this could be under a regional approach. This would necessitate the convening of a regional consultation to establish a framework for defining national and regional priorities. This process can be greatly enhanced through the shared experiences of CARICOM countries in their efforts to respond to climate change.

A National Climate Change Committee should be established and members should include the participants at the consultations, since they represent a broad stakeholder base. This committee would have to be appointed by the Council of Ministers. The Dutch Caribbean Nature Alliance is the only regional environmental body, and has demonstrated success in achieving its mandate. This organisation or its approach to regional implementation may be used to address energy and climate change issues in the Netherlands Antilles and Aruba.

Table 15
List of participants at the consultations in the Netherlands Antilles

Name	Organisation	Position	Phone	E-mail
Y. Raveneau	Amigu di Tera (Friends of the Earth Curaçao)	President	737-3965	amiguditera@gmail.com
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D. Werdekker	Curaçao Hospitality and Tourism Association	Executive Vice President	465-1005	don@chata.org
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D. Garmers	Directorate of Development Cooperation	Senior Project Officer	461-1866	Donaldito.garmers@gov.an
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Name	Organisation	Position	Phone	E-mail
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P. Hoetjes	Directorate of Public Health, Department of Environment and Nature	Senior Policy Advisor	433-9307	paul@mina.vomil.an
L. Buth	Directorate of Public Health, Department of Environment and Nature	Head Department	433-9302	letitia@mina.vomil.an
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J. Lieww	Vereniging Bedrijfsleven Curaçao (VBC)	Director	461-1210	info@vbc.an

12. Opening remarks by the Prime Minister of the Netherlands Antilles, Mrs. Emily Jongh-Elhage

Director of the Directorate of Foreign Relations, Mr. Eduard Mendes de Gouveia, Representatives of the Economic Commission for Latin America and the Caribbean, Representatives of stakeholders in the field of environment and other relevant fields, ladies and gentlemen, good morning.

Under a year ago, I had the pleasure of being in attendance in New York at the International Women Leaders Global Security Summit. During this summit at which female leaders from across the globe discussed the most pressing challenges for international security, climate change was identified as one of the major threats to the survival of humanity.

Upon my return to Curaçao, when asked by the organisers of the summit to identify which of the four themes that were discussed in New York would have my particular attention, without hesitation I agreed to champion in the Netherlands Antilles the cause of climate change. My reasons for this were simple. Climate change will have catastrophic consequences for our livelihood on this planet and we in the Netherlands Antilles were doing so little -if not to say nothing at all- about it.

I am therefore all the more content that one of the islands of the Netherlands Antilles has been selected to be a part of this initiative by the Economic Commission for Latin America and the Caribbean

in collaboration with the United Kingdom of Great Britain and Northern Ireland to carry out a study on the economic effects of climate change in the Caribbean.

Ladies and Gentlemen,

Our country is not yet a party to the United Nations Framework Convention on Climate Change neither to the Kyoto Protocol. At present we are looking at getting national legislation in place so as to pave the way for the Netherlands Antilles to accede to the Convention and Protocol.

It is important that as a community we are fully cognizant of the demands that will be placed upon us once we become party to the aforementioned UN legal instruments. We will most likely have to modify our current way of life in order to also contribute to a more sustainable planet. Government and all stakeholders must collaborate so as to make the public aware of what is at stake if we are not prepared to act expediently. I would therefore like to make use of this opportunity to exhort all of you present here this morning to work closely with the Central and Island Governments of our country on this important issue.

Dear participants, awareness precedes action. It is my profound hope that the presence here today of the ECLAC will act as a catalyst for us here in the Netherlands Antilles to start doing our part as a member of the international community in dealing with the exigencies of climate change. I thank you.

SAINT LUCIA



Source: <http://www.worldtravelguide.net/country/263/map/Caribbean/St-Lucia.html>

H. SAINT LUCIA

1. Introduction and brief summary of the discussions

A meeting with stakeholders took place on 15 October 2008 at the Ministry of Economic Affairs. The meeting started with opening remarks by a representative of the Ministry of Physical Development, the Environment, Housing, Urban Renewal and Local Government, and the delivery of presentations on the Stern Review and the RECC by ECLAC.

Recent global debates recommend GHG stabilisation levels between 450-500 ppm. However, this translates to an average global warming of almost 2°C, which still presents the risk of exceeding temperature thresholds in biophysical systems, and increases sea levels which would severely impact Caribbean states. Any new global agreements must therefore lead to the achievement of substantial emission reductions, well below 450 ppm and not above 350 ppm.

In light of the recent flooding experienced in Saint Lucia, the representative from the National Emergency and Management Office (NEMO) used the opportunity to apprise the meeting of that organisation's work. NEMO uses the recognition of anniversaries of severe climatic events to build awareness about that event and other related issues. The National Emergency Plan was authorised by Cabinet in 2007, and the Prime Minister has overall responsibility for disaster management. Pre-strike meetings are held to apprise him of the state of readiness of the country. The disaster committee provides a damage assessment within 48 hours of the strike. This committee is comprised of sector teams which assess the damage for particular sectors using the ECLAC methodology.

NEMO's early warning flood system is installed in the upper catchment areas to monitor rainfall regimes. The system essentially works like rain gauges and trigger an instant alarm in times of danger. As the water in the gauge rises, the system contacts the Meteorological Office and this triggers an alarm to a network of disaster volunteers who immediately take action. The telephone company of Saint Lucia is a member of NEMO and whenever the script concerning a disaster is emailed to them, they send out alerts via text messages to their mobile customers. To ensure that the system functions optimally, it is linked to national and community plans.

The Disaster Preparedness and Response Act 13 was passed in 2000 but, at that time, there were no regulations to support it. It was revised in 2006 complete with regulations, but the new Act was not assented to. NEMO therefore operates with the Act of 2000 and with the regulations developed in 2006, one of which addresses mandatory evacuation. The Physical Planning Unit and NEMO have undertaken a Hazard Mapping Exercise of the Castries Watershed and a landslide and storm surge hazard map for the entire island. NEMO is challenged by lack of capacity. The Office will be relocating to a new and well-equipped Emergency Operations Centre.

The Ministry of Tourism encourages accommodation facilities to have their own disaster management plan in place, as part of the requirement for ISO9000 certification. Having done so, they are marketed on the Ministry's website as being certified. The ministry has also undertaken public outreach initiatives regarding energy efficiency. The older accommodation facilities have been inspected, rewired, and the lighting fixtures relocated to provide more effective and efficient lighting. Newer buildings are designed to optimise natural lighting.

While two hotels are Green Globe certified, it is proving difficult to increase this number. The sector is not yet feeling the impacts of climate change despite the bleaching of corals, but the fishers are complaining of reduced catches. Since the tourism sector is so critical to the economy of Saint. Lucia,

permission is often easily granted for the development of new golf courses. A carrying capacity study of golf courses is needed.

There is often a discrepancy between the approved development plans and what is constructed as there is inadequate monitoring. In some cases, unplanned development leads to landslides. The Physical Planning Unit is now revising its laws to include EIA regulations. Currently, EIAs are mandated for some development and these are carried out. However, there is no monitoring of whether or not the developer has adhered to guidelines, and there is no enforcement if there is no compliance. The 16-year old building code has been revised to include climate change, but it is still in draft format.

All electricity in Saint Lucia is generated from three diesel-fired plants. Lucelec, Saint Lucia's sole electricity company strongly promotes energy efficiency, particularly in recent times when the price of fossil fuel was high. The Electricity Supply Act ensures that Lucelec remains the sole supplier, but provisions are made for the independent production of electricity by the producer's own means.

Saint Lucia is in the process of completing its Second National Communication to the UNFCCC, which will include socio-economic scenarios up to 2025, and feasible responses based on their national circumstances. National circumstances are such that their contribution to total global emissions is low, but small island developing states are being pressured by the international community to take on mitigation obligations.

However, Saint Lucia continues to pursue a sustainable energy mix. The National Energy Policy is almost complete and establishes the goals and procedures for the energy sector in Saint Lucia. This communication defines priorities for the development and operation of a cost-effective and reliable energy sector, while balancing the effects on the national and global environment.

The policy provides for the following related to renewable energy:

- Through the use of accelerated tax depreciation, removal or reduction of trade barriers on renewable energy equipment or investment-tax credits for capital costs, renewable energy projects will be more financeable, thereby providing greater comfort to the lenders that there will be sufficient revenues to pay the debt
- The Government of Saint Lucia could provide a tax credit for the purchase of energy-efficient appliances and renewable energy technologies. The Inland Revenue Department offers tax exemptions for solar water heaters.

The Government of Saint Lucia is exploring the use of wind energy for the production of electricity, but land acquisition has been a problem. Also, geothermal energy was being explored in Soufriere in the south, but legal issues have prevented any progress on this initiative.

The OECS Environment and Sustainable Development Unit (ESDU) has developed the framework for a regional land-use management plan for the next 25 years to guide countries in making better planning and investment decisions, in order to reduce the risk of future natural disasters.

Saint Lucia is one of the two CARICOM countries that have a Cabinet-approved Climate Change Adaptation Policy.

2. Country overview

Saint Lucia (13°59'N, 61°W) is a Small Island Developing State situated approximately mid-way in the Lesser Antillean Arc in the Caribbean archipelago. It sits on an ancient volcanic ridge connecting

Martinique to the north and Saint Vincent to the south. It has an area of 616 square kilometers and an estimated population (2000) of 156,300. Saint Lucia is classified as a middle-income Small Island Developing State.

The island of Saint Lucia lies within the north-east Trade Wind belt and is normally under an easterly flow of moist warm air. Its location in the Atlantic Ocean/Caribbean Sea suggests that ambient sea surface temperatures vary little from 26.7°C at any time. The island receives an almost constant amount of surface solar radiation from month to month. These factors combine to give the island a climate (tropical maritime) with a fairly constant high air temperature averaging near 28°C, but rarely rising above 33°C or falling below 20°C.

The Government of Saint Lucia is officially promoting tourism as a key sector of the island's economy. This is apparent in various policy documents, such as the 1996 to 1998 and 2000 to 2002 Medium Term Economic Strategies and more recently, in the Draft National Tourism Policy (2003). One of the main objectives of this new policy is to establish tourism as a strategic economic development priority by ensuring that it receives primary consideration when allocating financial, technical and physical resources. Its ultimate goal is to ensure that benefits generated by tourism are as widely distributed as possible throughout the nation and among local communities.

The sustained growth in the economy over the past decade has resulted in an increasing demand for energy. This demand is further exacerbated by rapid growth in the energy intensive tourism sector, which has replaced agriculture as the leading economic sector. Saint Lucia relies almost exclusively on imported fossil fuels to meet its energy needs. Of the total annual consumption of 109642.64 Tons of Oil Equivalent in 2000, only an estimated 1% was met from indigenous sources, mainly in the form of firewood, charcoal and agricultural residues. As is generally the case in small, non-industrialised economies, the main consumption sectors are electricity generation (28%), and transport (24%). All electricity in Saint Lucia is generated from diesel-fired plants. Recent economic growth has resulted in a sustained increase in demand of 4.3% over the past decade.

3. Overview of Saint Lucia's participation in international and regional climate change responses

St. Lucia, a developing (Non-Annex I) country, ratified the UNFCCC on 14 June 1993 and signed the Kyoto Protocol in 1998. The island's First National Communications was submitted to the UNFCCC Secretariat in November 2001 and the Second National Communications is currently in preparation.

Saint Lucia participated in several regional projects. The CPACC project was developed to support Caribbean countries in preparing to cope with the adverse effects of global climate change, particularly sea level rise in coastal and marine areas, through vulnerability assessment, adaptation planning and related capacity building.

Saint Lucia has also participated in the follow-up regional climate change project, the ACCC project, which was implemented from 2001 to 2004. This project was designed to sustain activities initiated under CPACC and to address issues of adaptation and capacity building not undertaken by CPACC, and further, built capacity for climate change adaptation in the Caribbean region. ACCC also facilitated the transformation of the Regional Project Implementation Unit, originally established through CPACC, into a legal regional entity for climate change (the Centre). It did so by providing the resources to develop a comprehensive business plan for the Centre and a strategy to ensure its financial sustainability.

The MACC project commenced in 2004 and was completed in December 2008. The project's main objective was to mainstream climate change adaptation strategies into the sustainable development

agendas of the small-island and low-lying states of CARICOM. MACC adopted a learning-by-doing approach to capacity building, consolidated the achievements of CPACC and ACCC, continued to strengthen institutional capacity and the knowledge base, and deepened awareness and participation. Project components included:

- Building capacity to identify climate change risks – Among other things, this included the strengthening of networks to monitor impacts on regional climate, downscaling global climate models, and developing impact scenarios
- Building capacity to reduce vulnerability to climate change
- Building capacity to effectively access and utilise resources to minimise the costs of climate change
- Public education and outreach.

On 1 February 2007, the World Bank GEF-funded SPACC project to implement adaptation measures in coastal zones became effective. The objective of the project is to support efforts by Dominica, Saint Lucia, and Saint Vincent and the Grenadines to implement specific (integrated) pilot adaptation measures addressing the impacts of climate change on the natural resource base of the region, focusing on bio-diversity and land degradation along coastal and near-coastal areas. The new grant complements the goals of the MACC project. It applies the lessons and information gathered through the CPACC project by supporting targeted adaptation measures, which seek to reduce the impacts of climate change on bio-diversity and land degradation.

Specifically, the project seeks to:

- Preserve the ecosystem functioning in Morne Diablotin and Morne Trois Pitons National Parks in Dominica that are affected by climate change impacts
- Maintain the health of coastal ecosystems in the Vieux Fort area in Saint Lucia that are being affected by climate change and ensure that other stressors are stabilized
- Incorporate lessons from strengthening of key infrastructure into local hazards management plan and building guidelines in Saint Lucia
- Stabilise remaining Black Mangrove (*Avicennia germinans*) stands in Union Island (measured through area, density and productivity) affected by climate change impacts.

4. Institutional framework to address climate change

Table 16 shows the institutional structure that currently participates in climate change responses in Saint Lucia, as well as regionally.

Table 16
Institutions in Saint Lucia with responsibilities linked to climate change.

Agency	Responsibility	Scope
Sustainable Development and Environment Section of the Ministry of Planning, Development, Environment and Housing	Institutional responsibility for management of climate change concerns in Saint Lucia. This section coordinates activities for the implementation of many of the environmental conventions to which Saint Lucia is party. Among its ongoing activities in relation to climate change are, efforts aimed at sensitisation of principal stakeholders, public awareness, and capacity building on matters relating to sustainable development. In terms of	National

Agency	Responsibility	Scope
	the UNFCCC, the main activities at this stage revolve around implementation of the responsibilities relating to the reporting and other requirements of the convention, measures to promote capacity building, and public awareness.	
National Climate Change Committee (NCCC)	A multi-sectoral steering committee comprising various public and private sector agencies provides technical input on climate change to the Sustainable Development Unit.	National
The Physical Planning and Development Division	Land use planning and development control. In this context it is responsible for the administration of the Physical Planning and Development Act (2001). The Division contributes to management of protected areas through the management of the EIA process. It also provides technical support to the protected areas management agencies in the preparation of maps and the hosting of spatial databases for protected areas.	National
Meteorological Department	The collection and analysis of meteorological data.	National
Caribbean Community Climate Change Centre (CCCCC)	<p>The Caribbean Community Climate Change Centre coordinates the Caribbean region's response to climate change. Officially opened in August 2005, the Centre is the key node for information on climate change issues and on the region's response to managing and adapting to climate change.</p> <p>It is the official repository and clearing house for regional climate change data, providing climate change-related policy advice and guidelines to the Caribbean Community (CARICOM) member states through the CARICOM Secretariat. In this role, the Centre is recognised by the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Environment Programme (UNEP), and other international agencies as the focal point for climate change issues in the Caribbean. It has also been recognised by the United Nations Institute for Training and Research (UNITAR) as a Centre of excellence, one of an elite few.</p>	Regional (CARICOM, UKOTs, Cuba)
OECS-ESDU	<p>The Environment and Sustainable Development Unit of the Organisation of Eastern Caribbean States (OECS-ESDU) is the entity within the OECS Secretariat that is responsible for the provision of natural resources and environmental management services to the member states of the OECS.</p> <p>The mandate of the OECS-ESDU is to assist member states in all matters pertaining to the sustainable use of natural resources to ensure the sustainability of livelihoods of the peoples of the OECS.</p>	Regional (OECS)

5. Legislative and policy framework to address climate change

(a) National Climate Change Policy and Strategy

Under the CPACC project, Saint Lucia has prepared a Climate Change Adaptation Policy as well as an Adaptation Strategy. The National Climate Change Adaptation (NCCA) Policy:

- Expresses the Government of Saint Lucia's recognition of the fact that climate change is indeed occurring and that it has significant implications for the island
- States the objective of government's National Climate Policy including: (a) avoiding, minimising or adapting to the negative impacts of climate change on Saint Lucia's natural, economic and social systems; and (b) fostering the development and application of appropriate legal and institutional systems; and management mechanisms for planning for, and responding to climate change
- States the principles which will guide the implementation of policy, including stakeholder involvement and public awareness and involvement in international negotiations
- Identifies objectives and broad action areas under various areas / resource categories including agriculture, human health, water resources, tourism and coastal resources. These objectives include the conduct of appropriate climate change monitoring and data gathering programmes, formulation of a national land use plan, incorporation of climate change considerations into national health planning, conduct of an inventory of water resources inclusive of ground-water, and development and implementation of appropriate building regulations
- Identifies appropriate planning and management mechanisms including the establishment of appropriate legal and administrative systems and the development of an appropriate database and information exchange network
- Identifies key agencies
- Makes appropriate provisions for monitoring and review through the National Climate Change Committee, which was re-established in 1999 with the sanction of Cabinet.

The National Climate Change Adaptation Strategy attempts to build on the Policy by identifying and rationalizing appropriate strategies and actions according to priority, time frame, resource needs and institutional responsibility. This Policy identifies the Ministry of Planning as the agency with responsibility for climate change activities. As such, that Ministry is mandated to coordinate implementation of the Strategy. Additionally, the National Climate Change Committee, or its successor, shall monitor the implementation of the Strategy and shall provide guidance to the Ministry of Planning and the other agencies involved in implementation of the Strategy. The Committee shall also ensure that Saint Lucia fulfills its obligations under the UNFCCC, the Kyoto Protocol, and other related regional and international conventions and agreements. Given the scope of the NCCA and the multiplicity of activities to be undertaken simultaneously in the implementation, it would be necessary to establish a dedicated unit within the Ministry of Planning to coordinate efforts. This proposed Climate Change Unit shall be provided with appropriate professional, technical and administrative resources to allow it to fulfill its mandate. It is recognised however, that to a large extent, NCCA activities are to form part of the work programmes of numerous agencies. The Climate Change Unit shall therefore serve as the Secretariat to the Climate Change Committee, or its successor body, while coordinating implementation of the Strategy and certain key activities falling within its responsibility.

Saint Lucia also has legislation for the protection and management of its biodiversity, which ultimately supports climate change adaptation and mitigation efforts. This legislation includes:

- Forest, Soil and Water Conservation Act, 1945
- Saint Lucia National Trust Act, 1975
- Wildlife Protection Act, 1980
- Fisheries Act, 1984
- Land Conservation and Improvement Act, 1992
- National Conservation Authority Act, 1999
- Physical Planning and Development Act, 2001

(b) Coastal Zone Action Plan

In 2001, the Government of Saint Lucia, with assistance from the European Union, embarked on an initiative aimed at establishing institutional arrangements which would facilitate the future development and management of the island's coastal zone. A CZM project, housed in the Ministry of Agriculture, Forestry and Fisheries was established and assigned the task of preparing a coastal zone related policy and guidelines document. The main output of this process was a CZM policy entitled "Coastal Zone Management in Saint Lucia: Policy, Guidelines and Selected Projects". This policy was approved and adopted by the Cabinet of Ministers in 2004 and aims to guide CZM in Saint Lucia.

(c) Biodiversity Action Plan (BAP)

The Saint Lucia BAP recognises impacts of large numbers of tourists on the marine and coastal diversity of the Soufrière area of the country. The BAP specifically acknowledges that the carrying capacity for recreational use and water pollution discharge to sensitive reef areas which was exceeded by 1990. The plan also addresses conservation of the historic island fishing industry. In 1992, several institutions in conjunction with native fishermen came together to produce a sustainable management plan for fishery resources, embodied in the Soufrière Marine Management Area (SMMA).

The Saint Lucia BAP features significant involvement from the University of the West Indies. Specific, detailed attention is given to three species of threatened marine turtles, a variety of vulnerable birds, and a number of pelagic fishes and cetaceans. In terms of habitat conservation, the plan focuses attention on the biologically productive mangrove swamps, and notes that virtually all mangrove areas had already come under national protection by 1984.

(d) Sustainable Energy Plan

Currently, energy experts from the Climate Institute and the Organisation of American States, together with the Ministry of Planning, Development, Environment and Housing are finalizing the Sustainable Energy Plan. This Plan lays out a strategy for the maintenance and growth of the energy sector in Saint Lucia through the establishment of energy sector targets and the implementation of actions. This will create a policy and regulatory framework to encourage diversification of the local energy market, and the promotion of energy efficiency and conservation.

6. Key sectors

The sectors and systems identified as most vulnerable are listed as:

- Tourism
- Agriculture
- Human settlement and coastal defence

- Health.

An integrated assessment, using water as a cross-cutting issue, was recommended.

7. Overview of research and studies on climate change

(a) CPACC

Through the implementation of the CPACC project, Saint Lucia benefited from the following:

- Under Component 1, a Sea Level/Climate Monitoring Network (Regional) was designed for the 11 participating CPACC countries, which provided a standardised set of instruments to measure water levels, vertical land motion, air and sea temperature, and velocity precipitation and other site specific variables
- Establishment of a framework for a CRIS
- Articulation of a National Climate Change Issues Paper which explores the projected climate change impacts on Saint Lucia, and feasible adaptation options to address these³⁷
- National Climate Change Policy and Implementation Plan: A draft integrated management and planning framework for cost-effective response and adaptation planning and management. This includes the identification of policy options and instruments that may help initiate the implementation of a long-term programme of adaptation to climate change
- Enhancement of capacity in the institutions collaborating with the project
- Economic valuation of coastal and marine resources, which assisted Saint Lucia in applying the tools of resource valuation, environmental accounting, and environmental decision-making, for use in the development of policies and economic and regulatory approaches.

(b) ACCC Project

Through the implementation of the ACCC project, Saint Lucia benefited from the following:

- Development and distribution of risk management guidelines for climate change adaptation decision making; political endorsement (by CARICOM) of the business plan and establishment of the basis of financial self-sustainability for the CCCCC
- Development of a guide to assist EIA practitioners in CARICOM countries to integrate climate change in the EIA process
- A draft regional PEO strategy
- Development and handover to MACC of the organization's website
- Successful launch of a Master's Programme in climate change (the first set of graduates, in 2003, included eight students)
- Staff training and development at CIMH in climate trend analysis, in order to strengthen climate change capacity
- Implementation of pilot projects on adaptation studies in the water, health and agricultural sectors.

³⁷ Expert judgment, in accordance with IPCC regional projections, was used to complete this document, as no downscaled scenarios were available for St. Lucia at that time.

(c) MACC

The project's outputs will be monitored and evaluated to contribute to the long-term sustainability of project activities and objectives. Outputs from which Saint Lucia benefited include:

- The mainstreaming of adaptation to climate change into national and sectoral planning and policies through the use of climate models developed and customised during the project
- A strong PEO programme and a comprehensive communications strategy including all stakeholders in the Caribbean mass media
- The creation of an environment conducive to the implementation of measures for adaptation to climate change.

(d) Economic Valuation of Coral Reefs in Tobago and Saint Lucia

The project was led by the World Resources Institute, and was implemented in close collaboration with the Institute of Marine Affairs in Trinidad and Tobago, the Buccoo Reef Trust of Tobago, the Caribbean Natural Resources Institute, UWI Sustainable Economic Development Unit, the Tobago House of Assembly, and the Government of Saint Lucia. The economic benefits derived from coral reefs are vital to the economies of small island States in the Caribbean. Economic valuation of these benefits helps to guide the wise, sustainable use of these resources.³⁸

(e) SPACC

This programme is piloting an initiative in the south of Saint Lucia to reduce the vulnerability of water resources that are important for a thriving tourism industry. The Coconut Bay hotel, which has a water park, is the demonstration site for this initiative which involves rainwater collection, sewage treatment and re-use of gray water for irrigation and toilets.

The insurance industry in Saint Lucia has expressed interest in climate change (particularly hurricanes and storm surges); however, there is need for raised awareness as to how that industry can play a role in reducing the vulnerability of systems. Net outflows from the industry are large as they need to purchase re-insurance from outside the region. The hazard maps from the Physical Planning Unit and NEMO can create scenarios for certain areas to better identify their levels of vulnerability. The insurance company can use this information to develop an incentive package for insurance customers. This approach should be complemented by a public awareness programme in the vulnerable communities.

Additionally, consultations and project outputs have informed the development of a Regional Climate Change Adaptation Strategy, which is currently being circulated for comment.

8. Other initiatives relevant to climate change

Much research has already been undertaken into the potential for exploring geothermal energy in Saint Lucia. However, an additional assessment of the island's market potential for renewable energy is necessary. Potential energy sources include biomass, wind, solar and geothermal. These energy sources can provide energy services with almost zero emissions whilst improving local technology and providing job opportunities. The Sustainable Energy Plan aspires to produce an electricity generation mix by introducing a Renewable Portfolio Standard, which will ensure that a specific percentage of electricity is generated from renewable sources. This will ultimately result in 30% of installed capacity being delivered from renewable sources by 2010.

³⁸ http://pdf.wri.org/coastal_capital_summary.pdf

(a) Solar Energy for Bouton

Solar photovoltaic technology was identified within one project as a means to bring electricity to sites that are either inaccessible because of mountainous terrain or have low electricity demand and therefore makes electrical grids too expensive to install. In addition, it was found that solar PVs could play a useful role in powering nature parks and marine navigation aids along the rocky coast.

The community of Bouton is in an isolated location on the west coast of Saint Lucia. The utility company estimated the cost of including the community in the grid at US\$300,000. A village school with a single large hall and minor office space, which is also used as a community center, adult teaching facility and as an emergency hurricane shelter. A PV system was proposed for this community and developed by the Saint Lucia Sustainable Development Science and Technology Office, and the United Nations Trust Fund. This PV system was successfully implemented in 1999, with electricity generated directly from solar panels. Electricity generated by solar energy now means that lighting, computers, televisions and VCRs are accessible to the school. The installation included:

- Solar panel sections of 200 watts placed onto the roof
- A locking battery container made from corrosion free recycled plastic, located inside the teacher's storage room
- An inverter of 2,400 watts, which supplies power to standard fixtures and appliances.

(b) SMMA

A collaborative and participatory process over an 18-month period among multiple stakeholders, led to the official establishment of the SMMA in 1995. As a result of this process, an eleven kilometer-length part of coastline was sub-divided into several zones, (marine reserves, fishing priority areas, yacht mooring areas, recreational areas and multiple use areas) catering to various users and uses. A co-management arrangement allows all stakeholders to provide input during potential conflicts and resolutions, with formal support from the Cabinet of Ministers, and support for the institutional and legal arrangements for the SMMA in 2000. Over the years, the SMMA has benefited from funding from a number of agencies; the Caribbean Conservation Association, Environmental and Coastal Resources Project, and the French Government. Currently, the SMMA is self-financing.

(c) Talvan Rapid Riverbank Rehabilitation

The quality of water in the Talvan water catchment has been affected to a large extent, by some of the inappropriate agricultural land management practices within the area. The problem of water pollution by solid waste and agro-chemicals prompted the establishment of community education programmes and a river clean-up campaign. Reforestation projects and riverbank stabilisation measures were implemented to address the issue of soil erosion along riverbanks. One of the most salient components derived from the project was community empowerment, which was addressed through workshops, technical training sessions and exchange programmes with similarly established groups (both local and subregional).

As a result of the reduction of riverbank erosion through short-and long-term bio-engineering strategies, and decreases in the level of pollutants such as agrochemicals, human effluents and animal waste, there has been a noted improvement in the quality of drinking water. The mechanism developed to facilitate the creation of community-managed catchment areas and effective methodologies for rapid riverbank rehabilitation can be replicated within other similar areas. As a result of the work of the Talvan Water Catchment Group, there has been the establishment of over 1137.8 metres of stabilized riverbank

and 751 vegetative wattles laid down along the riverbank, as well as increased public awareness of the work and aims of the group.

(d) Saint Lucia Solid Waste Management Authority

The Saint Lucia Solid Waste Management Authority was established by an Act of Parliament in 1996, with a mandate to provide coordinated and integrated systems for the collection, treatment, recycling and disposal of solid waste. One of its primary activities is the improvement of conditions at the two existing solid waste disposal sites located at Ciceron in the north and Vieux Fort in the south. The Ciceron and Vieux Fort sites served as the main disposal sites used by Saint Lucia for the last 10 years, receiving approximately 200,000 metric tons of waste per year. Domestic and institutional wastes comprise 70% of the total waste, while green waste, industrial waste, and commercial waste make up for 10% of the total waste respectively. Poor disposal techniques caused environmental degradation and potential risks to public health. Specific issues of concern include: fly and vermin infestation, uncontrolled burning, contamination of surface water, offensive odours, deterioration in visual aesthetics, wind-blown litter, and encroachment on nearby agricultural and ecologically significant land areas.

9. Relevant data on Saint Lucia

(a) Meteorological data

St Lucia Meteorological Services (SLMS) began operating in 1968 as part of the Department of Civil Aviation. The SLMS is now a division of the Ministry of Communications, Works, Transport and Public Utilities, and operates two manned weather stations. The main meteorological office is at the Hewanorra Airport. The SLMS also has 21 automatic weather stations deployed island-wide.

The SLMS is responsible for the provision of meteorological data and information to Saint Lucia, and works closely with NEMO mitigation and management. The SLMS has developed a number of linkages over the years with both government and non-government agencies, especially with the Ministries of Agriculture, Tourism and Planning.

(b) Comprehensive socio-economic data

- United Nations statistical website (<http://unstats.un.org/unsd/default.htm>)
- Saint Lucia Government Statistics Department (<http://www.stats.gov.lc/>)
- Eastern Caribbean Central Bank (<http://www.eccb-centralbank.org/>).

10. Needs and gaps

- Better monitoring and enforcement of policy implementation
- More human resources to address climate change issues
- Costing of impacts and responses
- Vulnerability assessments for sectors and geographic regions within Saint Lucia
- More funding for public outreach.

11. Conclusions and recommendations

Saint Lucia's geographic location makes it prone to natural disasters. The increasing intensity of extreme events renders the island more vulnerable. Despite extensive legislation, national-level action and enforcement appear to be inadequate. However, Saint Lucia experiences great success with community-

based initiatives, where smaller stakeholder groups are encouraged to take ownership of a response to a real problem that impacts their livelihoods. This approach can perhaps be repeated in areas where there is need, such as, adopting adaptation measures in vulnerable coastal communities and employing solar lighting where electrification from the grid is not accessible.

NEMO has a functioning system of awareness and preparedness in communities and within the sectors. This existing framework should be used to build awareness of climate change and have it mainstreamed into sectoral planning.

Table 17
List of participants at the consultations in Saint Lucia

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TRINIDAD AND TOBAGO



Source: <http://www.worldtravelguide.net/country/282/map/Caribbean/Trinidad-and-Tobago.html>

I. TRINIDAD AND TOBAGO

1. Introduction and brief summary of the discussions

This consultation was held at the Environmental Management Authority on 30 October 2008. The Director of the Ministry of Planning, Housing and the Environment delivered brief opening remarks and welcomed the participants who represented a wide stakeholder base – government, private sector, academia, and non-governmental organizations. The consultation was regarded as a timely initiative to address the adverse impacts of climate change confronting Trinidad and Tobago and it was hoped that this initiative, in costing impacts and response options, would mobilise action and result in greater collaboration amongst stakeholders to help shape the much needed response to climate change.

Trinidad and Tobago is one of the 12 CARICOM countries which participated in regional climate change adaptation projects since 1998.³⁹ It was felt at the time, as a small island state whose contribution to the global emissions was negligible, adaptation to the adverse effects of climate change should be a priority.

However, whilst Trinidad and Tobago's contribution to total global emissions is small (0.1%), per capita emissions are significantly higher than those of other Caribbean countries and marginally higher than that of the United States.

It was felt that the linkages between climate change and trade be considered, as developed countries to which Trinidad and Tobago exports could impose barriers as a result of the country's high per capita emissions. Unlike the other Caribbean countries, tourism in Trinidad and Tobago was generally not seen as important in the context of using resources to make this sector more resilient to climate change impacts despite the fact that tourism is important to Tobago.

2. Country overview

The Republic of Trinidad and Tobago is a two-island State located at the southern-eastern end of the Caribbean archipelago. Trinidad and Tobago together, comprise a total land area of 5,126 km², with the island of Trinidad having an area of 4,826 km² and Tobago, the smaller of the two, an area of 300 km². As a result of their southerly location, Trinidad and Tobago experiences two relatively distinct seasonal climatic types.

- Tropical Maritime: warm days and cool nights with rainfall usually in the form of showers due to daytime convection. This typifies the early to mid-dry season months of January to April
- Modified Moist Equatorial: low wind speeds with hot humid days and nights and a marked increase in rainfall that is not always convective. During this period, the area repeatedly comes under the influence of equatorial weather systems.

The two climate types described above result in two distinct seasons – a dry season from January to May and a wet or rainy season from June to December. Tobago, the more northerly of the two islands experiences a more desiccated dry season and Trinidad, a more saturated wet season.

Unlike most Caribbean countries, Trinidad and Tobago has a relatively significant industrial base with 43% (in 2007) of its GDP derived from the energy sector. It is the second largest energy producer in the Caribbean Sea, after Venezuela, and the leading supplier of liquid natural gas to the United States.

³⁹ CPACC, ACCC, MACC.

The energy sector continues to expand with growth in production, exports and exploration, and foreign direct investment in the expansion of the Atlantic Liquefied Natural Gas facility. With new operational facilities supporting export capacity and new investment supporting construction activity, real GDP growth is expected to continue. Whilst oil and gas keep the economy strong, the government is aware of its high dependence on earnings from the energy sector, and is encouraging diversification into the non-energy sector.

Agricultural production on the other hand, primarily comprises less than 1% of GDP, while manufacturing contributes between 7% and 8%. Tourism in Trinidad and Tobago is by comparison very small and centered mainly in Tobago. The tourism industry currently represents 13.8% of total GDP in Trinidad and Tobago.⁴⁰

3. Overview of Trinidad & Tobago's participation in international and regional climate change responses

Trinidad and Tobago, classified as a Non-Annex I country, signed the UNFCCC on the 11 June 1992, and ratified the Convention on 24 June 1994. Trinidad and Tobago is not bound by specific targets for greenhouse gas emissions.

While the Initial National Communications of Trinidad and Tobago, submitted in 2001 responded to the UNFCCC there are no specific legal instruments that have been enacted based on the UNFCCC, other than a range of existing legislation and policies such as mandates of relevant agencies. Trinidad and Tobago is now in the process of completing its Second National Communications.

Other multilateral conventions to which Trinidad and Tobago is party have relevance and linkages to responding to climate change. These conventions are:

- CBD
- UNFCC
- United Nations Convention on Desertification
- CITES: Ratified in 1973, limits international trade in endangered species
- SPAW from the Cartagena Convention
- Convention for the Protection and Development of the Marine Environment of the Wider Caribbean (Cartagena Convention): Ratified in 1983, includes protection of marine and coastal ecosystems; oil spills
- MARPOL
- International Code of Conduct on Responsible Fishing: Voluntary, non-binding, promoted by FAO
- Convention on Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks on the High Seas 1995
- Inter-Government Agreement on Fisheries (IGA) among CARICOM: To coordinate and manage marine fisheries in the CARICOM area
- International Commission for the Conservation of Atlantic Tuna
- Law of the Sea Convention, UNCLOS III 1982: To cooperate in management of migratory large pelagics (tuna, billfish), some sharks, dolphin fish

⁴⁰ Acolla Lewis, Leslie-Ann Jordan, Department of Management Studies, University of the West Indies, St. Augustine, Trinidad, 2007.

- Agenda 21
- International Plant Protection Convention
- International Tropical Timber Agreement
- Agenda 21 and SIDS POA
- Ramsar Convention
- Basel Convention
- Vienna Convention for the Protection of the Ozone Layer/ Montreal Protocol for the Phase-Out of Ozone Depleting Substances
- Stockholm Convention on Persistent Organic Pollutants

(a) CPACC

Through the implementation of the CPACC project, Trinidad and Tobago benefited from the following:

- Under Component 1, a Sea Level/Climate Monitoring Network (Regional) was designed for the 11 participating CPACC countries, and provided a standardised set of instruments to measure water levels, vertical land motion, air and sea temperature and velocity, precipitation, and other site specific variables
- Establishment of a framework for a CRIS
- Articulation of a National Climate Change Issues Paper which explores the projected climate change impacts on Trinidad and Tobago, and feasible adaptation options to address these⁴¹
- National Climate Change Policy and Implementation Plan: a draft integrated management and planning framework for cost-effective response and adaptation planning and management. This includes the identification of policy options and instruments that may help initiate the implementation of a long-term programme of adaptation to climate change
- Enhancement of capacity in the institutions collaborating with the project
- Economic valuation of coastal and marine resources which assisted Trinidad and Tobago in applying the tools of resource valuation, environmental accounting and environmental decision-making, for use in the development of policies, and economic and regulatory approaches.

(b) ACCC Project

Through the implementation of the ACCC project, Trinidad and Tobago benefited from the following:

- Development and distribution of risk management guidelines for climate change adaptation decision making; political endorsement (by CARICOM) of the business plan and establishment of the basis of financial self-sustainability for the CCCCC
- Development of a guide to assist EIA practitioners in CARICOM countries to integrate climate change in the EIA process
- A draft regional PEO strategy

⁴¹ Expert judgment in accordance with IPCC regional projections was used to complete this document as no downscaled scenarios were available for Trinidad and Tobago at that time.

- Development and handover to MACC of the organization's website
- Successful launch of a Master's Programme in climate change (the first set of graduates in 2003 included eight students)
- Statistically downscaled climate scenarios developed for Jamaica, Trinidad and Tobago, and Barbados
- Staff training and development at the CIMH in climate trend analysis, in order to strengthen climate change capacity
- Implementation of pilot projects on adaptation studies in the water, health, and agricultural sectors.

(c) MACC Project

This project commenced in 2004 and was due for completion in December 2008. The project's main objective is to mainstream climate change adaptation strategies into the sustainable development agendas of the small-island and low-lying States of CARICOM. MACC adopted a learning-by-doing approach to capacity building, consolidated the achievements of CPACC and ACCC, continued to strengthen institutional capacity and the knowledge base, and deepened awareness and participation. Project components include:

- Building capacity to identify climate change risks. Among other things, this included the strengthening of networks to monitor impacts on regional climate, downscaling global climate models, and developing impact scenarios
- Building capacity to reduce vulnerability to climate change;
- Building capacity to effectively access and utilise resources to minimise the costs of climate change
- PEO.

The project's outputs will be monitored and evaluated to contribute to the long-term sustainability of project activities and objectives. Outputs from which Trinidad and Tobago benefited include:

- The mainstreaming of adaptation to climate change into national and sectoral planning and policies, through the use of climate models developed and customised through the project
- A strong PEO programme, and a comprehensive communications strategy including all stakeholders in the Caribbean mass media
- The creation of an environment conducive to the implementation of measures for adaptation to climate change.

Additionally, consultations and project outputs have informed the development of a CARICOM Regional Climate Change Adaptation Strategy, which is currently being circulated for comment.

4. Institutional framework to address climate change

(a) National Institutions

The government, cognizant of climate change and its impacts, established a Cabinet appointed Working Group to Determine the Implications of Global Warming, Climate Change and Sea level rise in 1990. The Working Group is currently chaired by the Environmental Management Authority and advises

government on climate related policies. The Working Group has representation from relevant government ministries, NGOs and the private sector.

The National Environmental Policy (Government of the Republic of Trinidad and Tobago, National Environmental Policy, 1998) aims at the constructive use and conservation of the environment for the promotion of economic and social development, in order to maintain and improve the quality of life to which all citizens are entitled. The goal of the policy therefore, is the conservation and wise use of the environment of Trinidad and Tobago to provide adequately for meeting the needs of present and future generations and enhancing the quality of life.

Climate change matters at the international level are the responsibility of the Ministry of Planning, Housing and the Environment. Domestically, this responsibility is vested in the Environmental Management Authority (EMA), a statutory body under the Ministry of the Environment. This mandate is embodied in the Environmental Management Act (Environmental Management Act No.3, 2000) which undertakes the following:

- The establishment of an EMA to coordinate, facilitate, and oversee execution of the national environmental strategies and programmes
- The promotion of public awareness of environmental concerns
- The establishment of an effective regulatory regime which will protect, enhance and conserve the environment.

However, although the EMA serves as the focal point and the coordinating agency for all climate change activities, it is necessary for other relevant sectors to be involved in a more meaningful way. This is because it has been recognised that climate change is not strictly an environmental management issue.

(b) Regional Institutions

The CCCCC coordinates the Caribbean region's response to climate change. Officially opened in August 2005, the Centre is the key node for information on climate change issues and on the region's response to managing and adapting to climate change in the Caribbean.

It is the official repository and clearing house for regional climate change data, providing climate change-related policy advice and guidelines to CARICOM member States through the CARICOM Secretariat. In this role, the Centre is recognised by the UNFCCC, UNEP, and other international agencies as the focal point for climate change issues in the Caribbean. It has also been recognised by the United Nations Institute for Training and Research as a Centre of Excellence, one of an elite few.

5. Legislative and policy framework to address climate change

There is no climate change policy, however provisions for relevant legislation include:

- A Vehicle Emissions Act
- National Environmental Policy and Code
- Air and Noise Pollution Management
- Water Pollution Management
- Waste Management
- Management of Hazardous Substances
- Designation of Environmentally Sensitive Areas and Species

- Certificate of Environmental Clearance Rules
- Environmental Management Act No. 34 (1995)
- Forest Act (Revised 1980).

Further, the sustainable development effort has been buttressed by a number of milestone developments in the legal, institutional, regulatory and policy frameworks including:

- Enactment of the Environmental Management Act, 2000 – and subsidiary legislation related to sensitive areas and species, water, air and noise pollution
- Establishment of the EMA
- Establishment of an Environmental Commission
- Establishment of a Green Fund
- Formulation of a National Wetland Policy
- Formulation of an Integrated Water Resources Management Policy
- Establishment of a National Emergency Management Agency for Tobago and the Office for Disaster Preparedness and Management for Trinidad
- Formulation of a National Biodiversity Strategy and Action Plan
- Social and Economic Policy Framework, 2004
- National Environmental Policy, 1998
- Draft Environmental Code
- Draft Policy on Environmental Education
- Forest Policy of Trinidad and Tobago, 1998
- Draft Strategic Plan, Forestry Division, 2003-2007
- Sector Policy for Food Production and Marine Resources, 2001-2005, Ministry of Agriculture, Land and Marine Resources
- Policy Directions for Marine Fisheries of Trinidad and Tobago in the 1990s (1994)
- Plan for Managing the Marine Fisheries of Trinidad and Tobago (Draft)
- Energy Policy Green Paper, 1998
- A National Tourism Policy for Trinidad and Tobago, 2001
- Draft Marine Policy Document, Fisheries Division, 1994
- Waterfront Development Plan
- Bi-lateral Oil Spill Contingency Plan (with Venezuela)
- Draft National Strategic Development Planning Framework, 2000-2006
- Tobago Strategic Plan, 1998-2013
- Tourism Master Plan, 1995: To direct the growth of the tourism industry in Trinidad and Tobago
- National Physical Development Plan, 1984
- Land Use Policy
- Northern Range Hillside Policy, 1988
- Wildlife Strategic Plan, 1995

- Draft National Strategy of Trinidad and Tobago for the Control of Air Pollution from Anthropogenic Sources- EMA, 2000
- Tobago Development Plan Vol.1, 1998
- Tobago Regional Physical Development Plan, 1991

A draft National Energy Policy has been submitted to the Senate over one year ago, and a draft Sustainable Tourism Policy also exists.

6. Key sectors

There was consensus that the key sectors which the country would wish the project to address are:

- Energy
- Health
- Agriculture (including Fisheries and Forestry)
- Tourism (particularly in Tobago).

7. Overview of research and studies on climate change

(a) CARICOM Climate Change Projects

As a result of its participation in the CARICOM regional climate change projects (1998-2003), Trinidad and Tobago completed a pilot initiative to undertake an economic valuation of coastal and marine resources. This component looked at estimated gains from policy action with regard to adaptation to climate change, and intended to inform policy showing that the early costs can be easily offset by gains later. The pilot site selected was a cultural heritage site and the Defensive Expenditures model was used for the economic valuation.

During this period, Trinidad and Tobago also undertook an inventory of coastal resources and established databases and information systems. This data reside primarily at the Institute of Marine Affairs which serves as the Regional Archiving Centre for sea level and sea temperature data. It is uncertain if, subsequent to the completion of these projects, data were collected and archived.

(b) UWI, St. Augustine Campus

This campus will be undertaking a study on the socio-economic impacts of sea level rise on coastal communities by January 2009. It will also seek to guide post-graduate students to undertake studies in vulnerable areas related to climate change in Trinidad and Tobago.

(i) *Variations in Sea Level on the West Trinidad Coast, by Keith M. Miller, Department of Surveying and Land Information, University of the West Indies, Trinidad.*

This work uses the least squares methods by applying them to spectral analysis of intermittent data sets acquired over periods of six and nine years at two locations in Trinidad. The resulting sea level models that include 13 periodic components, datum bias, trend, and atmospheric pressure are validated using fundamental historical information and observations that form the subject of discussion among local professional surveyors. Results show that while sea level at a location in north Trinidad is rising at the rate of about 1 mm a year, the change at a southern site is about four times this amount. Horizontal

movement has been measured across a tectonic fault that divides the island, and it is now apparent that there may be some vertical motion on this or some other fault lines in the region.

(c) The Petroleum Company of Trinidad and Tobago (PETROTRIN)

(i) Vulnerability Assessment Survey of Oil and Gas Facilities to Climate-Driven Sea Level Rises and Storm Surges on the West Coast of Trinidad⁴²

PETROTRIN has conducted a detailed vulnerability assessment survey and storm surge simulation, through modeling for the west coast of Trinidad stretching from Vessigny River in the north to Cap-de-Ville in the south along the Gulf of Paria. This survey was undertaken so as to identify the impacts of climate driven, sea level rises and extreme storm surge events on PETROTRIN and Trinidad Marine (TRINMAR) infrastructure and operations.

The methodology used to conduct this vulnerability assessment survey involved coupling Atmosphere-Ocean General Circulation Model (A-OGCM) simulations of future sea level rises and Total Arbiter of Storms estimates of storm surges to a GIS-based inundation and erosion scheme, so as to estimate land loss and infrastructure facilities at risk from inundation and erosion.

The results of the study show that field installations in PETROTRIN at Guapo, such as access roads, pipelines, storage tanks and even pump jacks, and the offshore operations of TRINMAR including offshore platforms, jetties and harbours and administrative buildings would be at severe risk of inundation and erosion deriving from sea level rises and storm surge events.

(ii) Vulnerability Assessment of the Port and Coastal Infrastructure Facilities of TRINMAR on the Gulf of Paria, Trinidad to Sea Level Rise⁴³

On account of the growth and expansion in the oil and gas sectors, TRINMAR, the marine arm of PETROTRIN, the State-owned oil and gas company of Trinidad and Tobago, is required to move its port facilities from its current location at Point Fortin to a location 7 km south, namely Mont Pellier estate on Irois Bay in the Gulf of Paria. This paper addresses the vulnerability of the Mont Pellier site to rising sea levels, as caused by climate change.

Sea level scenarios are created from the outputs of two coupled A-OGCMs, namely the Canadian and British models. Photogrammetric and field surveys are used to create a Digital Elevation Model of the study area.

Future scenarios of sea level rise in 2031, 2051 and 2071, coupled with estimations of accelerated erosion rates based on the Bruun principle, are then used to assess the vulnerability of the port and built infrastructure to future sea levels.

In light of these vulnerability assessments, adaptation measures are proposed to minimise the impacts of future sea levels on the Mont Pellier port and harbour facilities.

Other relevant studies include:

- Singh, B and A. El Fouladi. 2005. Phase 1 Vulnerability Assessment Survey for the Pointe-a-Pierre Foreshore Area. Climate Change Institute, Petrotrin, 118p.

⁴² B. Singh, A. El Fouladi & K. Ramnath, <http://library.witpress.com/pages/PaperInfo.asp?PaperID=18786>.

⁴³ B. Singh, A. El Fouladi & K. Ramnath. <http://library.witpress.com/pages/PaperInfo.asp?PaperID=16205>

- Singh, B and A. El Fouladi. 2006. Phase 11 Vulnerability Assessment Survey for the Pointe-a-Pierre Foreshore Area. Climate Change Institute, Petrotrin, 253p.

8. Other initiatives relevant to climate change

(a) Climate Change Impacts on Biodiversity Project

Over the past 18 months, the Caribbean Natural Resources Institute (CANARI) has been implementing a project entitled Climate Change and Biodiversity in the Caribbean through funding from the John T. and Catherine D. MacArthur Foundation. The objectives of the project are:

- To increase understanding and consensus on what is known about the predicted climate change trends and their impact on biodiversity in the islands of the Caribbean
- To identify gaps in regional knowledge and develop a research agenda to address these gaps and, to identify the capacities that need to be developed to implement the agenda.

The first stage of the project has been a desk review of the current state of knowledge on the impacts of climate change on biodiversity in the region and the related research capacities. Working groups were established for this purpose and the following draft reports have been prepared:

- Climate change models and scenarios for the islands of the Caribbean
- Climate change impacts on marine and coastal biodiversity in the islands of the Caribbean
- Climate change impacts on terrestrial biodiversity in the islands of the Caribbean.

(b) British Petroleum of Trinidad and Tobago (bPTT)

Oil companies in Trinidad are progressive in implementing measures that assist in reducing its greenhouse gas emissions. bPTT is BP's principal operating company in Trinidad and Tobago and is a subsidiary of the United Kingdom oil company BP p.l.c. (previously known as British Petroleum). It therefore operates using the BP standards defined for its operations in other parts of the world. Complying with these standards is imperative in order to supply certain markets. It is one of the leading companies in the Trinidad and Tobago energy sector, exploring for, and producing, oil and gas in the marine areas off the east coast of Trinidad. bPTT is the group's third largest strategic performance unit and represents 10% of the BP group's hydrocarbon production.

BP ensures efficiency of its operations by creating lower carbon products. However, BP's role in addressing climate change goes beyond minimizing their emissions. The company is involved in contributing to the policy debate, supporting research and developing new, cleaner technologies in power and transport. Their environmental management system (EMS) provides a framework for managing environmental impacts on and offshore, and for driving continuous improvement in performance through the minimisation of operational impacts. The EMS is certified to International Standards ISO 14001– the environmental management standard.

Managing operational GHG emissions has been a component of bPTT's efforts to tackle climate change and to operate as efficiently as possible. Operational GHG emissions across the BP Group in 2005 totalled 78.0 million tonnes (Mte) of CO₂ equivalent on a direct equity basis. In Trinidad and Tobago, GHG emissions declined in 2005, principally as a result of the Teak, Samaan and Poui oilfields divestment. US\$10 million was invested to significantly reduce venting and flaring, since the main sources of emission are flaring, venting and combustion. Another initiative entitled, Cannonball, was designed to have no routine venting, flaring or process equipment onboard coupled with features such as

micro-turbines which are more fuel efficient. All of these features minimise platform emissions and all of the equipment at the plant is audited for emissions each month. BPTT's objective is to get as close to "zero emissions" as possible. It is also important to note that BPTT doubled its profits since they started to reduce their emissions.

BPTT has formed a partnership with local and international non-governmental organizations as well as government agencies to introduce a pilot solar water heating project within the tourism industry in both Trinidad and Tobago. The project is being implemented mainly to provide the Government of the Republic of Trinidad and Tobago with first-hand information and knowledge on system performance and efficiencies obtained from this solar energy application. The information will influence the formulation of a national renewable energy policy and programme for the country.

(c) PETROTRIN

PETROTRIN is an integrated energy company involved in the exploration, production, refining and marketing of energy resources. PETROTRIN recognises the need to exist as a viable commercial entity without compromising the integrity of the environment. It is therefore committed to the principle of sustainable development and continual improvement of its environmental performance.

(d) Trinidad Cement Limited, TCL Group

This company has proposed a number of projects for the CDM.

(e) Carbon Trading

In February this year, the Trinidad and Tobago Petroleum Conference was held. This two-day workshop titled, "The Future of Energy", explored the possibilities and implications of developing Carbon Capture and Storage (CCS) activities in Trinidad and Tobago, with particular emphasis on Enhanced Oil Recovery (EOR). The workshop provided participants with grounding in the technical issues associated with EOR and explored the wider policy issues around issues of CCS. One of the possible measures for removing carbon dioxide from the atmosphere is CCS. In 2005, the IPCC WG III presented a Special Report on CCS, which has also informed the IPCC WG III Fourth Assessment Report published in 2007.

Trinidad and Tobago presents an interesting potential location for CCS for a number of reasons:

- A well developed and rapidly expanding petrochemical and metals sector has resulted in a number of existing and potential point sources of CO₂ emissions (in particular, power-generation and ammonia production)
- A mature oil industry with a large number of on - and near-shore oil wells in close proximity to point-sources of CO₂
- Some initial experience with the use of CO₂ in EOR
- A well developed engineering and geological profession, and well developed research capacity at UWI and the University of Trinidad and Tobago.

(f) National Reafforestation Project

A major forestry project was initiated involving the following component:

- The reafforestation of critical watersheds

- The establishment of new forest plantations
- The introduction of agro-forestry
- Under this initiative, a total of 404.69 hectares is targeted to be planted annually
- The initial phase of the project will be completed in five years. Areas will be chosen according to environmental sensitivity, impact on forest fires and land capability classification.

(g) The Community-Based Environmental Protection and Enhancement Programme (CEPEP)

This was introduced to undertake community-based environmental projects, through the employment of small contractors throughout the country. The programme is intended to specifically address the issues of indiscriminate dumping of solid and other waste along roadways, open spaces and watercourses; and the maintenance of the aforementioned areas. The programme also empowers communities to improve the condition of the local environment. CEPEP has had far-reaching economic, social and environmental benefits, including entrepreneurial development and employment creation. In this regard, over 100 new entrepreneurs have been established providing employment for over 6,000 citizens and ensuring a sustainable relationship between the environment and the community.

9. Relevant data on Trinidad and Tobago

The Initial National Communications provides the first inventory of:

- Carbon dioxide, methane and nitrous oxide
- Indirect GHGs, nitrogen oxide, carbon monoxide, non-methane volatile organic compounds and sulphur dioxide are also estimated
- Time series data on temperature, rainfall
- Projections for temperature, sea-level and rainfall up to 2100
- Soil and land-use capability databases
- Energy.

Hydrofluorocarbons, perfluorocompounds and SF₆ were not inventoried due to lack of data. Various data sources were used for the estimation of emissions by sources, and removal by sinks of the greenhouse gases for Trinidad and Tobago. Government departments and agencies including ministry of energy and energy industries, ministry of agriculture, land and marine resources and ministry of works and transport, provided most of the data used in this study. Others were the Central Bank, Central Statistical Office, Water and Sewerage Authority, EMA, and PETROTRIN. Data were also sourced directly from manufacturing and agro-based industries. Except in the case of agriculture and land-use change/forestry, the GHG inventory was prepared for a period of one calendar year time period. The time periods used for the compilation of GHG inventory for Agriculture, and Land-Use Change/Forestry for the base year of 1990, were recommended in the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 1: Reporting Instructions. Emission factors used for computations in this study were the default values given in the IPCC Guidelines for National GHG Inventories. A greenhouse gas inventory was not prepared for the solvent and other product use categories due to the lack of data in this area for the year 1990. Socio-economic data can be sourced from the Central Statistical Office.

In addition, a new project to establish a statistical database for the Ministry of Public Utilities and the Environment was approved by Cabinet in 2003. The objective of this project was to strengthen the ability of the Ministry to make informed policy decisions through the development of an appropriate database. The creation of a database has prevented the duplication of efforts in data gathering and gaps in

data availability. The project primarily entailed networking the existing sources of data into one comprehensive database and developing standard procedures for collecting data so that the data generated would allow for common usage.

The EMA collects data on emissions and is developing emissions standards for Trinidad and Tobago.

10. Needs and gaps

- Sectoral risk modeling and vulnerability studies especially for agriculture, tourism and energy
- National-level impact study
- Emphasis on demand-side management of energy use
- Cost-benefit analysis of legal instruments / fiscal incentives
- Emissions studies
- More sea level data.

11. Conclusion and recommendations

It was stated in the 2000 State of the Environment Report that Trinidad and Tobago was the most industrialised country in the Commonwealth Caribbean region, and one of the major contributors to GHG emissions among developing countries on a per capita basis. The growing transportation and energy sectors will likely continue to be significant sources of air pollution.

Despite the lack of a binding obligation to the UNFCCC, Trinidad and Tobago has sought to manage its emissions through policy, as well as voluntary compliance by the main emitters in the energy sector. The Second National Communications should more specifically address the means for GHG emission abatement.

Table 18
List of participants at the consultations in Trinidad

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IV. REGIONAL INITIATIVES RELEVANT TO CLIMATE CHANGE ADAPTATION AND MITIGATION

A. ASSOCIATION OF CARIBBEAN STATES (ACS)

- Disaster Reduction Plan of Action (for the Dominican Republic and the wider Caribbean.): This Action Plan has been completed and will guide the work of the ACS for the next five years as the entity for consultation, cooperation and concerted action for disaster reduction in the greater Caribbean.

B. ASSESSMENTS OF IMPACTS AND ADAPTATIONS TO CLIMATE CHANGE IN MULTIPLE REGIONS AND SECTORS

1. Caribbean-based initiatives

- Capacity building in the region through two workshops on adapting to climate change in Latin America and the Caribbean
- Research project on climate change impacts through the incidence of dengue fever in the region.

2. Generic initiatives

- Capacity building programme through research for developing countries. Started in 2002, the programme provided financial support to 24 regional study teams to conduct 3-year investigations of climate change impacts, adaptation, and vulnerability in 46 developing countries.

C. AOSIS

1. Generic initiatives

- Support of the Barbados Programme of Action of the Sustainable Development of Small Island Developing States (BPoA) in 1994
- Support for the implementation strategy for the BPoAs “Mauritius Strategy for the further implementation of the BPoA” in 2005.

D. CARICOM

1. ACCC Project, 2001-2004

- Developed risk management guidelines for climate change adaptation decision making
- Developed a guide to assist EIA practitioners integrate climate change into EIA process
- Drafted a regional PEO strategy
- Launched a Master’s Programme in climate change
- Statistically downscaled climate scenarios development for Jamaica, Trinidad and Tobago, and Barbados
- Provided staff training at CIMH in climate trend analysis

- Implemented pilot projects: the vulnerability of the agricultural sector in Guyana, the water sector in Belize and Jamaica, and the tourism sector in Barbados.

2. MACC Project, 2004-2007

- Mainstreaming of adaptation to climate change into national and sectoral planning through climate models developed and customized through the project.
- Drafted a public education and outreach programme, and a comprehensive communications strategy to engage all stakeholders of the Caribbean mass media.
- Caribbean Catastrophic Risk Insurance Facility will provide insurance coverage to participating countries at a significantly lower rate than individual states could obtain on their own, by enabling participating countries to pool their individual risks into a single, more diversified portfolio. CCRIF will use parametric insurance contracts that make payments based on an independent and transparent measure, e.g. based on wind speed or earthquake intensity.

3. CPACC Project, 1997-2001

- This GEF-funded project included four regional projects as well as five pilot projects in various CARICOM countries
- Regional projects:
 - Design and establish a sea level/climate monitoring network
 - Establish databases and information systems
 - Create an inventory of coastal resources
 - Formulate initial adaptation policies
- Pilot projects:
 - Coral reef monitoring for climate change (Bahamas, Belize, and Jamaica)
 - Coastal vulnerability and risk assessment (Barbados, Guyana, and Grenada)
 - Economic valuation of coastal and marine resources (Dominica, Saint Lucia, and Trinidad and Tobago)
 - Formulation of economic/regulatory proposals (Antigua and Barbuda, and St Kitts and Nevis)
 - National communications (St Vincent and the Grenadines).

4. The Jagdeo Initiative

- The Jagdeo Initiative is a strategy for removing constraints to the development of agriculture in the Caribbean. It builds upon past regional efforts to develop a Common Agricultural Policy (CAP), and identifies 10 key binding constraints faced by the sector.

5. CARICOM Energy Programme, 2008

- Caribbean Regional Energy Development Programme
- Regional Energy Policy
- Regional Sustainable Road Map
- CARICOM/EU Capacity Support
- Trinidad and Tobago's Energy Plan for CARICOM 2006

E. CCCCC

- Official repository and clearing house for regional climate change data, providing climate change-related policy advice and guidelines to the CARICOM member States through the CARICOM Secretariat
- The MACC project was transferred to the CCCCC (as executing agency) in 2006
- Enhancing Capacity for Adaptation to Climate Change in the Caribbean Overseas Territories of the United Kingdom, 2007-2010
- The British High Commission in Guyana has applied for funds to build climate change capacity in the member countries of CARICOM. If approved, CARICOM Secretariat and the CCCCC would be fully involved
- Japanese Trust Fund grant, to address uncertainty in regional modelling and developing a tool for economic assessment of adaptation options
- Regional Climate Change Adaptation Strategy, 2008.

F. CARIBBEAN DEVELOPMENT BANK (CDB)

- Starting to implement EIA methodology, “Sourcebook on the Integration of Natural Hazards into the Environmental Impact Assessment Process” that incorporates climate change
- CDB has representation on the board of the CCCCC and has helped the centre to establish their financial and administrative framework
- CDB is negotiating a technical assistance grant with the CCCCC to develop a project to provide relevant information for the region to bridge climate change science and decision-making processes
- CDB is in the process of recruiting a staff member dedicated to DRM and climate change.

G. CDEMA

- Lead agency in the implementation of the Comprehensive Disaster Risk Management Framework, 2007-2012
- CDEMA is the central agency for DRM in the Caribbean. It houses a documentation centre which provides a hazards database, vulnerability assessments, hazard maps, fact sheets, disaster risk management assistance, and many other resources
- CDEMA, in partnership with CDB, has developed the Model National Hazard Mitigation Policy for the Caribbean. This is a guide for CDEMA participating states and CDB borrowing member countries to develop national hazard mitigation policies
- CDEMA and CCCCC have a Memorandum of Understanding (MOU) to work together to find ways to link their activities on climate change and DRM.

H. CEHI

- The Caribbean Dialogue on Water and Climate Project: funded by the Netherlands-based International Secretariat for the Dialogue on Water and Climate. The Caribbean initiative is designed to promote the exchange of information and experiences on water and climate change
- Integrated Watershed and Coastal Areas Management Project: This GEF project, started in 2004 with the objective to assist the 13 participating Caribbean states to improve their watershed and coastal zone management practices in support of sustainable development

- Health Sector Disaster Preparedness for Floods Project: This is a collaboration between CEHI and PAHO to strengthen the capacity of the health sector to mitigate and respond to environmental issues related to floods following hurricanes or torrential rains, and to improve disaster response
- Climate Change and Health Project: CEHI is implementing component 7 of the Adapting to Climate Change in the Caribbean project, “Formulating Adaptation Strategies to Protect Human Health
- Saltwater Intrusion of Coastal Aquifers on Caribbean Islands Project: CEHI is collaborating with the Ministry of Housing, Lands and the Environment, Barbados, the Faculty of Pure and Applied Sciences UWI, to undertake this Organisation of American States-funded pilot project in Antigua, Barbados and Jamaica.

I. CANADIAN INTERNATIONAL DEVELOPMENT AGENCY (CIDA)

1. Caribbean based initiatives

- CIDA has been a key donor for the ACCC project
- CIDA will invest between US\$12-15 million in the Comprehensive Disaster Response Mechanism Framework over the next 5-10 years by supporting regional agencies like CDEMA, the Pan American Health Organization (PAHO) and UWI, as well as projects in communities.

J. DEPARTMENT FOR ENVIRONMENT, FOOD AND RURAL AFFAIRS

- The Providing Regional Climates for Impacts Studies climate model is partly funded by DEFRA.

K. DFID / DFID CARIBBEAN

- Important donor in the Comprehensive Disaster Management Framework, 2007-2012
- Currently engaging with Eastern Caribbean Donor group, and will seek to engage more closely with other regional donor groups and colleagues on the Caribbean rim of Central America to strengthen the Comprehensive Disaster Management Framework and other related activities
- DFID part funds the PRECIS model
- Contributor to the World Bank’s pilot, “Catastrophic Risk Insurance Facility (CRIF) in the Caribbean”
- Managing DFID-funded project, “Enhancing Capacity for Adaptation to Climate Change in the Caribbean UK Overseas Territories”, 2007-2010
- Funded a capacity building project for the United Kingdom Overseas Territories, “Preparing for and Adapting to Climate Change in the Caribbean” through the Overseas Territories Environment Programme, completed in 2005
- Funded research on “The Impacts of Global Climate Change on the UK Overseas Territories”, completed in 2001.

L. EUROPEAN COMMISSION (EC)

1. Caribbean based initiatives

- The European Union is investing in the institutional strengthening of CDEMA for the next 3 years with the objective of poverty reduction by integrating all aspects of DRM
- The EU has funding through the Natural Disaster Facility that could support DRM in the smaller islands of the Caribbean.

M. FOREIGN AND COMMONWEALTH OFFICE OF DFID

- Established the Global Opportunities Fund (GOF) to finance six thematic areas including climate change and energy.
- The British High Commission in Guyana has applied for GOF funds to build climate change capacity in the member countries of CARICOM, from Sept 2007-March 2009. This project includes:
 - A workshop to develop a regional climate change strategy, which will be presented to the CARICOM Heads of State
 - Training activities targeting economic and physical planning for policy makers, governance, and international climate change negotiation capacity
 - Developing practical action plans for sustainable tourism through the Sustainable Development GOF.

N. INTER-AMERICAN DEVELOPMENT BANK (IDB)

1. Caribbean-based initiatives

- Adaptation for Climate Change and Disaster Mitigation, Township Planning Strategies for Storm Surge in the Caribbean in partnership with CDEMA
- A regional risk management framework for the tourism sector in the Caribbean that contributes to the overall goal of reducing the vulnerability of the tourism sector to natural hazards
- IDB also supports CDEMA in the delivery of the CDRM and is encouraging CARICOM member States to include CDRM efforts in budget planning
- Sustainable Energy and Climate Change Initiative to support the Latin America and the Caribbean region in its urgent challenge to find economically and environmentally sound energy options.

2. Generic initiatives

- “The Bank Action Plan for Improving DRM”, 2005-2008 focuses on three priority fronts:
 - Country programming and portfolio management
 - Bank policy procedures and financial products
 - An organisational approach focusing on ex-ante risk reduction.
- Disaster Prevention Funds, two grant funding mechanisms:
 - From ordinary capital
 - The Multi-Donor Disaster Prevention Fund.
- Disaster Prevention Sector Facility provides a fast track loan approval process of up to US\$5 million to support countries

- Immediate Response Facility to very quickly make available loan resources to finance rehabilitation activities post-disaster
- Emergency Response Technical Co-operations, the IDB Country Representative has additional resources at discretion and can authorize up to US\$200,000 of grant financing for technical cooperation for immediate emergency response activities.

O. INTER-AMERICAN INSTITUTE FOR GLOBAL CHANGE RESEARCH

1. Caribbean-based initiatives

- Tropical Cyclones: Current characteristics and potential changes under a warmer climate (countries participating: Costa Rica, Cuba, Mexico and United States).
- Paleotempestology of the Caribbean Region: A multi-proxy, multi-site study of the spatial and temporal variability of Caribbean hurricane activity (countries participating: Canada, Costa Rica, Mexico and United States)
- Caribbean Coastal Scenarios Programme: Participating countries include Dominican Republic, Jamaica, Puerto Rico and United States.

P. IPCC

1. Generic initiatives

- The IPCC has produced in depth reports on the state of knowledge about climate change, its impacts and adaptation options (including the importance of building adaptive capacity, the role of disaster risk reduction and sustainable development) since 1990. Within these reports, small islands are considered separately.
 - 2007 report: <http://www.ipcc.ch/SPM13apr07.pdf>
 - 2001 report: http://www.grida.no/climate/ipcc_tar/
 - 1997 report on regional impacts: [http://www.ipcc.ch/pub/regional\(E\).pdf](http://www.ipcc.ch/pub/regional(E).pdf)
 - 1995 report: <http://www.ipcc.ch/pub/sarsum2.ht>

Q. JOINT NATURE CONSERVATION COMMITTEE

- Works on the implications of climate change on nature conservation in the United Kingdom and the United Kingdom Overseas Territories
- Funded a PhD thesis from the Tyndall Centre on “Implications of climate change for biodiversity in the UK Overseas Territories”, 2005
- Will continue to invest in assessing impacts of climate change on biodiversity and geo-diversity in the Overseas Territories and assist with surveillance programmes.

R. METEOROLOGY OFFICE / HADLEY CENTRE

- Provision and support of the climate modeling software PRECIS.

S. PAN AMERICAN HEALTH ORGANIZATION

1. Generic initiatives

- Disaster preparedness, management, and response are priorities in PAHOs Strategic Plan 2003-07, which highlights:
 - Disaster Preparedness

- Risk Reduction
- Disaster Response
- Technical Information Services (PAHO is a depository of information on disasters and health best practices and guidance)
- Training and capacity building
- Partnerships to Safeguard Health: PAHO/WHO works with Ministries of Health and promotes inter-country collaboration and mutual assistance agreements. For example, support is provided through the logistics support system, a joint venture of WHO, World Food Programme, United Nations Office for the Coordination of Humanitarian Affairs, United Nations Children's Fund, United Nations High Commissioner for Refugees and PAHO.

T. UNDP

1. Caribbean-based initiatives

- Support to Caribbean countries in the development of their Second National Communications to the UNFCCC
- UNDP delivers resources for adaptation through the World Bank GEF funds collected under the UNFCCC
- UNDP Caribbean Risk Management Initiative
- UNDP-GEF Adaptation Policy Framework

U. UNFCCC

- Initial National Communications⁴⁴ have been produced by 16 Caribbean states: Antigua, Bahamas, Barbados, Belize, Cuba, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago. As the United Kingdom Overseas Territories have not extended the UNFCCC to their islands, they have neither prepared National Communications nor are they included in the United Kingdom submissions.
- The UNFCCC, through GEF, provides resources for adaptation to climate change:
 - Strategic Priority on Adaptation is a GEF Trust fund that can be used for pilot and demonstration projects that address local adaptation needs and generate global benefits. Its aim is to increase the resilience and adaptive capacity of ecosystems and communities vulnerable to the adverse effects of climate change
 - Least Developed Country Fund is development focused, and designed to support projects addressing urgent and immediate adaptation needs of the least developed countries as identified in their National Adaptation Plans of Action⁴⁵
 - Special Climate Change Fund (SCCF) is development focused, and supports projects relating to adaptation, technology transfer and capacity building, energy, transport, industry, agriculture, forestry, and waste management, and economic diversification
 - Adaptation Fund is supported by a 2% share of the proceeds of the Clean Development Mechanism, and has the same objectives as the SCCF

⁴⁴ See Annex 3 in the section on the UNFCCC for a brief summary of the National Communications.

⁴⁵ Only least developed countries are eligible for the Least Developed Country Fund, and as such, in the Caribbean only Haiti is eligible. Haiti has now produced a NAPA although it is only available in French.

- The Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change (initial activities 2007-2008; second phase 2009-2010).

**V. UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT/
OFFICE OF U.S. FOREIGN DISASTER ASSISTANCE**

1. Generic initiatives

- The Parks in Peril Project (started in 2000) focuses on empowering and strengthening local non-governmental organizations, government organizations, communities, and municipalities to manage biodiversity and ecosystem functions, primarily those protected by national parks and other types of reserves.

W. UWI

- UWI, St. Augustine and CCCCC have signed a Memorandum of Understanding agreeing to cooperate and undertake joint ventures in the areas of research, education, training, and institutional strengthening in all aspects of climate change for the benefit of CARICOM
- UWI Cave Hill Campus offers a Masters Programme in Natural Resource and Environmental Management
- UWI Mona has research and graduate training in different areas relevant to climate change
- The Centre for Marine Sciences has the Caribbean Coastal Data Centre that serves CPACC by handling physical and biological data sets from the wider Caribbean region
- The Natural Hazards Management Programme
- Mona GIS has partnered with the UWI Unit for Disaster Studies to conduct natural hazards research for local and regional places.

X. WORLD BANK GEF

1. Caribbean initiatives

- Investment of US\$5.47 million in Dominica, Saint Lucia and Saint Vincent, through a CARIB-GEF special pilot project. "Implementation of Adaptation Measures in Coastal Zones", 2006-2011
- US\$10.95 million investment in MACC "Mainstreaming Adaptation to Climate Change" for 10 Caribbean states (plus Belize and Guyana), 2003-2007
- Investment of US\$6.2 million in CPACC for 9 Caribbean states (plus Belize and Guyana), 1997-2002
- Caribbean: CCRIF.

2. Generic initiatives

- Development of a computer-based tool: Assessment and Design for Adaptation to Climate Change- a Prototype Tool to screen proposed development projects for potential risks posed by climate change and variability. The tool is for use by bank staff and client governments among others.

V. SUMMARY AND CONCLUSIONS

A. GENERAL FINDINGS

While, for the most part, Caribbean countries contribute minimally to climate change, they may well be the most adversely affected and the least able to protect themselves. The most recent reports from the IPCC (4th Assessment Report), the Global Environment Outlook and the Stern Review, all agree that without urgent action, the opportunity to avoid irreversible damage will be lost.

Indeed, many advances have been made with respect to climate change responses in the region, particularly in addressing the scientific and policy implications of climate variability for the Caribbean. Some work has also been undertaken to assess impacts on key sectors. However, the magnitude of the challenge of climate change calls for more innovative thinking and action from policy makers to better support on-the-ground initiatives where they are most needed. Too few policymakers have acted on the warnings of technocrats and scientists and made the legislative and institutional changes that are not only required to fulfill obligations to multilateral agreements, but more importantly to ensure continued socio-economic development of their countries.

As a result, even though most Caribbean countries have the financial resources and technical capacity to implement some “no regrets” adaptation options, governments are still not yet disposed to investing in these measures. Most measures that have benefited from the support of policymakers, that might be determined as adaptive, are not the result of direct responses to climate change impacts. Rather, they indirectly meet other challenges such as investment in desalination plants in countries such as Antigua and Barbuda, Barbados, Trinidad and Tobago, the Netherlands Antilles and Aruba in order to address water stress as supplies are diminishing perhaps due to salt water intrusion into underground aquifers. Other adaptive practices, for example, water harvesting, mulch agriculture and the enactment of building codes are employed in several countries in the region, but these are still not informed by knowledge of the extent of climate change the region is expected to experience.

It is within this context that the decision to develop sectoral climate models would also appeal to policymakers, if the models could predict and quantify, with some measure of confidence, the impacts that are expected both nationally and regionally. Recent collaborations between the CCCCC and other regional and global centres of research on climate change have generated detailed projections by using downscaled Regional Climate Models that have a finer resolution that would be appropriate for representing the small islands of the Caribbean region.

B. ADAPT OR MITIGATE

Recent global debates recommend GHG stabilisation at 450-500 ppm. However, this translates to an average global warming of almost 2°C, which still presents the risk of exceeding temperature thresholds in biophysical systems, and may cause increased sea level rise which would severely impact Caribbean states. Any new global agreements must therefore lead to the achievement of substantial emission reductions in the shortest time frame possible, and significantly increase the level of resources available to vulnerable developing countries particularly SIDS and Least Developed Countries (LDCs), to assist their adaptation strategies. It is imperative that the necessary adaptive capacity of vulnerable countries be supported so that they are better able to respond and adapt to climate change.

However, the best adaptation strategies and plans will be meaningless in the absence of decisive global action to significantly reduce harmful greenhouse gas emissions, and comprehensively address climate change. The Caribbean should play its part, even in the absence of legally binding commitments.

Mitigation has typically been regarded as a secondary response, but there are “win-win” opportunities for such efforts in the Caribbean, particularly where fossil fuels are still the main source of energy.

C. REGIONAL CLIMATE CHANGE INITIATIVES

Five of the six CARICOM countries reviewed had completed a significant amount of work on climate change. This work includes:

- Vulnerability assessments
- Impact studies
- Modeling
- GHG inventories as part of their First National Communication to the UNFCCC
- National Capacity Self Assessments for Adaptation to Climate Change

More recently, Saint Lucia along with Dominica and Saint Vincent and the Grenadines have started a pilot project to implement adaptation options under the Special Programme for Adaptation to Climate Change in the Caribbean project (funded by the GEF and the Japanese Trust Fund), which is implementing adaptation measures in the coastal zone.

Montserrat, as an Overseas Territory of the United Kingdom, was not eligible to participate in these projects. However, along with four other United Kingdom Overseas Territories, it will be participating in a DFID-funded climate change programme implemented by the CCCCC. This project should have commenced on 1 January 2009. Additionally, in March 2008, the Government of Montserrat proposed the establishment of an OECS Climate Change Center on that island. The US\$3.5 million centre will focus on education and research on the impact of climate change on the smaller Caribbean islands, and is expected to raise awareness and motivate Caribbean nationals to develop and assist with the implementation of climate change and energy efficiency initiatives. The centre will feature systems for weather monitoring, sea level monitoring and tsunami warning, atmospheric gas and particulate matter monitoring and seismology. The climate change center will operate in collaboration with the CCCCC.

The Dutch Overseas Territories of Aruba and Curaçao had not previously participated in any climate change projects. However, they are in the process of drafting legislation to support their participation in the UNFCCC, with the expectation of ratification in the near future.

The Dominican Republic has done extensive work on climate change and has worked very closely with the climate experts in Cuba. In the Dominican Republic, data sets are extensive in scope and for the most part have been digitised.

D. INSTITUTIONAL FRAMEWORK

Those countries that have ratified the UNFCCC, have in place ministries responsible for climate change, designated UNFCCC focal points, and Cabinet or Senate-appointed national climate change committees. Climate change committees are multi-sectoral and may also include representation from the private sector and civil society organisations.

A number of CARICOM countries also have operational national Sustainable Development Councils, which were established with support from UNDP Capacity 21 programme. Further, all countries have disaster management institutions in place and their work is often linked to climate change.

E. LEGISLATIVE FRAMEWORK

Guyana completed their “National Climate Change Adaptation Policy and Implementation Plan” in 2002, and Saint Lucia’s Climate Change Adaptation Policy and Action Plan was adopted by Government in 2003. These measures aim to ensure that climate change adaptation becomes formally integrated into all plans, policies, and programmes at the national and community levels. These policy documents established, for the first time, a national adaptation planning and management framework based on an integrated “ecosystem” approach firmly established within the national planning context.

In September 2008 by Presidential decree, an Inter-sectoral Commission on Climate Change was established in the Dominican Republic.

F. KEY SECTORS

Generally, the sectors most frequently identified as the most vulnerable to climate change impacts are: tourism, agriculture, and health. These sectors were considered because of their contribution to GDP, employment and human well-being, without which economies cannot prosper. Energy and water resources were, in most instances, regarded as cross-cutting themes.

G. RESEARCH NEEDS AND GAPS REQUIRING ACTION

The greatest need expressed through all the consultations is that there should be an indication/quantification of economic value of action versus inaction. It was suggested that in the absence of such a strategy, Caribbean governments may continue to implement short-term measures to address adverse climate change impacts. It is therefore expected that outputs from this project would be mainstreamed into environmental and macro-economic policy development, and national development planning. The following is a list of other needs expressed throughout the consultations to varying degrees by each country.

- Technical training in the downscaling and use of climate models
- More science-policy interface to assist policy makers in making climate change preparedness decisions on the basis of the best information
- More regional technical capacity to address climate change risks and vulnerability
- Data collection and recovery. Some countries have data in hard copy, but do not have the resources for digitization of such data. This is necessary for inclusion of country-specific data in climate models, with a view to conducting simulations and therefore making projections of both consequence and cost. Also, some countries do not have a long time series of data on parameters that are required to reduce the uncertainty of climate models
- Public awareness – especially for policymakers
- More sector-specific impact studies where they do not exist
- Costing of climate change impacts and response options.

VI. RECOMMENDATIONS

Today's development decisions will influence tomorrow's climate and so, too, will tomorrow's climate influence the success of today's development decisions. The majority of such plans and projects should have life expectancies that should incorporate future climate conditions. The climate is susceptible to long-term changes in atmospheric and oceanic conditions that will impose both increased and new risks on many natural and human systems, especially as a result of changes in climate variability and the frequency and magnitude of extreme climatic events. In order for the Caribbean region to better prepare for, and respond to, climate change, the experiences and lessons from the suite of completed and ongoing initiatives need to finally bear tangible outcomes and provide new best-practices.

Where they are absent or are in-operational, it is necessary to develop and mainstream climate adaptation and mitigation strategies into development planning, poverty reduction and disaster risk reduction efforts at the national and regional levels. This should not require a dramatic departure from past and current achievements, and may be embarked upon incrementally by building on existing policies and programmes. The overall aim is to establish enduring institutional processes within government from national to local levels, and within the wider stakeholder community, to promote and facilitate mainstreaming into national planning and sectoral policies. One way of systematically mainstreaming climate change into development policy is through the conduct of cost-benefit analyses of a "Business as Usual (BAU)" scenario as well as of adaptive and mitigative strategies and policies. Great care must be taken when defining the BAU scenario and the concomitant responses for each participating country, as they should be developed within the context of economic growth assumptions, carbon emissions forecasts and the national policies guiding them, abatement cost estimates, and global warming damage functions.⁴⁶

From the point of view of the Dutch territories, there is an opportunity for the development of a climate change agenda which can benefit from the experiences of CARICOM countries. It is worthwhile to note that within the Netherlands Antilles, Sint Maarten and Curacao have opted for an autonomous country status within the Kingdom of the Netherlands similar to that of Aruba and this was effective in December 2008. The political status of Saba, Saint Eustatius and Bonaire, however have remained unchanged.

Given this change in political status, it was recommended that a regional consultation be held to define priorities, and that this would be led by Bonaire given its direct access to funds from the Netherlands. Other territories can also learn from the experiences and best-practices of Bonaire, since it is the most advanced in terms of environmental management and renewable energy.

Additionally, the following are recommended:

- Creation of additional synergies at the national and regional levels. This has been stymied very often as a result of projects being driven by the interests and agendas of donor agencies. However, greater coherence in planning for climate change may be facilitated through already established bodies that represent a wide stakeholder base, such as Sustainable Development Councils and National Climate Change Committees
- Promotion of synergies amongst donor agencies to complement national agendas, rather than duplicate actions. The approach may benefit from the data and information obtained from the

⁴⁶ The relation between changes in the climate, and reductions in economic activity relative to the rate that would be possible in an unaltered climate. (IPCC)

results of regional consultations and working groups that were supported and facilitated by the Mac Arthur Foundation that sought to define Caribbean priorities, needs and gaps

- A stronger regional presence at international negotiations related to climate change, particularly, as current emissions reduction targets are still inadequate for small-island and low-lying coastal developing states. This is being addressed through the CARICOM Task Force on Climate Change and Development which has been engaging in the development of a consolidated position to be represented at the 15th Session of the Conference of the Parties (COP) to the UNFCCC that will be held in Copenhagen, Denmark in December 2009. It is expected that this meeting should result in the development of a post-2012 Kyoto Protocol that may well impose emissions reduction targets on Non-Annex I countries such as SIDS.