ADAPTING TO A CHANGING CLIMATE
IN THE CARIBBEAN
AND SOUTH PACIFIC REGIONS

Guide to the Integration of Climate Change Adaptation into the Environmental Impact Assessment (EIA) Process

Adapting to Climate Change
in the Caribbean (ACCC) Project

CARICOM

South Pacific Regional
Environment Progamme

THE
WORLD
BANK

GEF

Canadian International
Development Agency

Agence canadienne de
développement international

The Guide to the Integration of Climate Change Adaptation into the Environment Impact Assessment Process has been developed as a collaborative effort between the Capacity Building for the Development of Adaptation Measures in Pacific Islands Countries (CBDAMPIC) Project and the Adapting to Climate Change in the Caribbean (ACCC) Project. Support for the publication of this document has been provided, in part, by the Mainstreaming Adaptation to Climate Change (MACC) project, funded by the Global Environment Facility (GEF) and implemented by the World Bank.

Capacity Building for the Development of Adaptation Measures in Pacific Islands Countries (CBDAMPIC) Project Overview

The CBDAMPIC project focuses on improving the sustainable livelihood of Pacific Island people by increasing their adaptive capacity to climate-related risks. The CDN $2.2 million initiative of the Canadian International Development Agency (CIDA) is being executed by the South Pacific Regional Environment Programme (SPREP). This is Canada's response to the call by Pacific island countries for assistance to develop and implement a capacity building programme that will reduce climate related risks at the national and community level. The three-year project (January 2002 to March 2005) involves four countries:

- Cook Islands
- Fiji
- Samoa
- Vanuatu

The overall project purpose is to develop and implement a capacity-building programme that will increase four Pacific Island countries' capability to reduce climate-related risks at the national and community level. Principal project outcomes include:
1. Climate change adaptation is mainstreamed into national and sectoral planning and budgeting processes; and
2. Communities' adaptive capacity to climate related risks and vulnerabilities increased.

The Projects five main outputs will ensure that these outcomes are realised.

Output 1 Increased awareness by policy and decision makers on climate change risks for their people's livelihoods and economic sectors and the adaptation options that could be put in place at national and community level to increase adaptive capacity.

Output 2 Senior government policy makers committed to integrate and mainstream climate change adaptation into national and sectoral policies and a process is in place to incorporate climate change risk management into national planning.

Output 3 Increased awareness by communities of the vulnerabilities associated with climate change and the adaptation options available (traditional and contemporary).

Output 4 Pilot projects implemented in communities to reduce their vulnerabilities to climate change related risks.

Output 5 Regional linkages developed and maintained that will ensure mutual advocacy platforms in the international arena and joint activities carried out to reduce vulnerabilities of Caribbean and Pacific regions to climate related risks.

It is expected that the project will increase the capabilities of Pacific island government institutions and communities to deal with vulnerabilities related to climate change and climatic extremes.

Further information on the CBDAMPIC project can be obtained from:
Taito Nakalevu, Climate Change Adaptation Officer
South Pacific Regional Environment Programme
PO Box 240, Apia, Samoa
Phone: (685) 21929
Fax: (685) 20231
taiton@sprep.org.ws
www.sprep.org.ws

Adapting to Climate Change in the Caribbean (ACCC) Project Overview

Adaptation to climate variations and change, and to sea level rise, is of fundamental economic and social importance to the countries of the Caribbean. The Adapting to Climate Change in the Caribbean (ACCC) project is funded by the Canadian International Development Agency (CIDA) and runs from October 2001 to March 2004. The project builds on the initial experience gained through the Caribbean Planning for Adaptation to Climate Change (CPACC) project, which concluded in December 2001. This US$2.1 million project involves 9 individual components that continue from CPACC in order to consolidate, extend and make sustainable climate change responses. They are also designed to lead into and complement the Global Environment Facility (GEF) program . Mainstreaming Adaptation to Climate Change (MACC). The nine components of the ACCC Project include:

Component 1: Development of Business Plan for Caribbean Climate Change Centre
Component 2: Public Education and Outreach (PEO)
Component 3: Risk Management Approach to Physical Planning
Component 4: Strengthening Regional Technical Capacity
Component 5: Adaptation Planning in Environmental Assessments
Component 6: Strategies for Adaptation in the Water Sector
Component 7: Adaptation Strategies to Protect Human Health
Component 8: Adaptation Strategies for Agriculture and Food
Component 9: Fostering Collaboration with non-CARICOM Countries

The outcomes from this initiative aim to ensure that:

- The Caribbean Community Climate Change Centre (soon to be established) becomes a sustainable institution for coordinating all climate change related activities in the region;
- The region builds climate change adaptation into planning and assessment processes in key economic and social sectors;
- The scientific and technical competence to address climate change issues is strengthened in the region;
- National and regional agencies can constructively engage in international climate change negotiations; and
- Citizens, the private sector and governments of the region have the knowledge to
- support and conduct appropriate climate change responses.

CARICOM countries participating in the ACCC Project:

- Antigua & Barbuda
- Bahamas
- Barbados
- Dominica
- Grenada
- Guyana
- Jamaica
- St. Lucia
- St. Kitts & Nevis
- St. Vincent & the Grenadines
- Trinidad & Tobago

The ACCC project is executed through the Canadian Executing Agency (CEA) which comprises Canadian firms, de Romilly and de Romilly Ltd. and GCSI - Global Change Strategies International Inc. Day-to-day implementation is the responsibility of the Regional Project Implementation Unit (RPIU), based in Barbados that was originally established for the CPACC Project. However, implementation is the full responsibility of the Caribbean Community (CARICOM) Secretariat.

For further information, please visit our website:
http://www.caribbeanclimate.org

Canadian International Development Agency
Agence canadienne de développement international

ISBN 976-600-170-7 (pbk). CARICOM Adapting to Climate Change in the Caribbean (ACCC) Project. Guide to the Integration of Climate Change Adaptation into the Environmental Impact Assessment Process. September 2004. ¢¢¢¢.

ADAPTING TO A CHANGING CLIMATE
IN THE CARIBBEAN
AND SOUTH PACIFIC REGIONS

Guide to the Integration of Climate Change Adaptation into the Environmental Impact Assessment (EIA) Process

Published by:
Caribbean Community (CARICOM)
and
South Pacific Regional Environment Programme (SPREP)

With assistance from:
Global Environment Facility (GEF)
World Bank
Canadian International Development Agency (CIDA)

September 2004

TABLE OF CONTENTS

LIST OF FIGURES

FOREWORD

The landmark United Nations Global Conference on Sustainable Development of Small Island Developing States (SIDS) held in Barbados in 1994 brought the issue of climate change impacts on the Caribbean, amongst others, to the fore. In the key strategic document emerging out of the Conference – the Barbados Programme of Action (BPOA) – *"climate change and sea level rise"* was one of the fourteen priority issues requiring *"urgent action"* from Caribbean nations. The small states in the Caribbean can do little to directly mitigate the tendency to global climate change. Consequently, their focus must necessarily be on adaptation. There have been two Caribbean regional climate change projects implemented over the past six years to plan for adaptation to the likely effects of climate change. From studies undertaken over this period, it has been established that the Region, already vulnerable to the effects of climate variability, will be more so affected by the impacts from projected climate change. The small island and low-lying coastal States will be vulnerable to the combined impacts of climate change and climate variability. Practical country – specific adaptation options have to be developed for countries in the Region to take account of the nature of the threat.

This document, *"Guide to the Integration of Climate Change Adaptation into the Environmental Impact Assessment Process,"* has been informed by ongoing work on adaptation in the Caribbean. It is one of the many outcomes of the CARICOM/CIDA "Adapting to Climate Change in the Caribbean (ACCC) Project," and benefits from collaboration between the regional disaster and the climate change communities in the effort to better manage potential disaster situations and reduce the losses associated with the yearly devastation experienced from climate-related events.

The ACCC project has also collaborated with the "Capacity Building for the Development of Adaptation Measures in Pacific Island Countries (CBDAMPIC) Project," implemented in the South Pacific, since the two regions share similar vulnerabilities to climate variability and change. This document speaks to how climate change considerations – such as, for example, projected storm activity and sea level rise scenarios – can be included in the process of environmental impact assessment (EIA). Conventional EIAs consider the impact of the development project on the environment. New thinking, as reflected in this document, suggests that we also need to consider the impact of the environment on the Project. The recent trends of increased damage to coastal infrastructure due to climate-related events, and the costs of rebuilding or rehabilitation clearly demonstrate the need for such consideration.

The collaboration of the ACCC and CBDAMPIC projects was made possible by resources from the Canadian International

Development Agency (CIDA), whose foresight has resulted in a ground-breaking activity that will serve to better guide development planning decisions in both the Caribbean and South Pacific regions. It is hoped that the approach adopted in this document will inform future planning and development decisions in small island and coastal developing countries which stand to be most adversely affected by climate change.

Edwin Carrington
Secretary-General
Caribbean Community
Georgetown, Guyana

Climate extreme events are catastrophic to the socio-economic and biophysical systems of Pacific and Caribbean island nations. These events draw back the curtain of development a number of years. Extreme climate events must therefore be part of the mainstream decision-making processes of island governments.

This guide to the integration of climate change adaptation within the Environmental Impact Assessments (EIA) process is an attempt by Caribbean and Pacific climate experts to mainstream climate change issues into the everyday decision-making processes of government ministries and departments. This guide is not an end in itself. It is an important first step toward building resilience into current and future development projects that will in turn contribute to reducing vulnerability. If adopted, the guide should help to 'trigger' climate change adaptation.

The Caribbean and Pacific regions have been working very closely on several important initiatives and thematic areas. This joint effort has resulted in this guide entitled: *"Guide to the Integration of Climate Change Adaptation into the Environmental Impact Assessment (EIA) Process."* This guide will assist EIA and climate change experts to address issues related to integrating climate change into the EIA process. This is cutting edge work and SPREP is privileged to collaborate with the Caribbean on this project. The high economic costs of climate-related disasters in the Pacific region have prompted the awareness of the need to be proactive in finding ways and means of reducing vulnerability and build resilience through adaptation. This guide points out some very practical ways in which climate change issues and concerns can be factored into the planning, evaluation and monitoring phases of an EIA process.

The effort between the two regions is made possible from assistance by the Government of Canada through funding of two climate change adaptation projects. I believe that working in collaboration and sharing information and resources is an important precedent for the two regions. This initiative needs to be supported and built upon further.

The foresight and efforts of the relevant officers and experts who authored this document should be commended. They have done a great service that will make a difference in preparations to adapt to the negative impacts of extreme events.

Asterio Takesy
Director
South Pacific Regional Environment Program (SPREP)
Apia, Samoa

EXECUTIVE SUMMARY

These guidelines have been developed to assist CARICOM and SPREP country practitioners with the integration of climate change adaptation considerations into the environmental impact assessment (EIA) process, thereby ensuring the selection and implementation of feasible options for development projects. The guidelines adopt a risk management approach for dealing with the existent uncertainties associated with the present status of our knowledge to climate change.

The document has been guided by the:

a)..*Review of Environmental Impact Assessment in Selected Countries of Latin-America and the Caribbean* that has recently been undertaken by the Inter-American Development Bank (IADB); and

b)..review of environmental impact assessment procedures in CARICOM countries that has been undertaken under the Adapting to Climate Change in the Caribbean (ACCC) program.

It is also informed in terms of its approach to environmental impact assessments by the World Bank's *Environmental Assessment Sourcebook*.

Although the document has been developed as an integral part of the *Guide to the Integration of Natural Hazards into the Environmental Impact Assessment Process* being developed by the Disaster Mitigation Facility for the Caribbean (DMFC) program, it serves as a "stand alone" reference source setting out the methodology and detailing the issues of relevance when undertaking the climate change adaptation component of Environmental Impact Assessments (EIAs). The main reason for this approach is that it allows climate change parameters to be developed and expanded on without any fear that it may be viewed as being too detailed and weighty for inclusion or integration into the EIA Process. The other reason is that the format and parameters used in EIAs are pretty much standard, with "Climate" being considered as one of the physical parameters (soils, hydrology, etc.) which has to be assessed and evaluated.

The Guide does not propose to establish a new or parallel EIA process but rather identifies a few simple steps to be taken when utilizing existing EIA processes and procedures. *Section 2* of the Guide provides that when considering the impacts of climate change, the EIA process should:

a)..evaluate a project's potential environmental risks and impacts in its area of influence;

b)..identify and evaluate potential impacts from climate change on the project's area of influence;

c)..examine project alternatives;

d)..identify ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse

environmental impacts and anticipated adverse impacts from climate change, and enhancing positive impacts; and

e)..include the process of managing and adapting to adverse environmental impacts and anticipated adverse impacts from climate change throughout project implementation.

In addressing anticipated adverse impacts from climate change, the Guide favours the implementation of appropriate adaptation planning and management mechanisms as part of the environmental management plan. *Section 3* of the document provides guidance on the process to address "cumulative effects" arising from multiple climate change related events. The guide includes a glossary of standard terms/definitions related to climate change and EIA. The annexes to the Guide provide the user with a range of relevant information on climate change modelling, climate scenarios and adaptation choices depending on the specific climate risk being addressed.

Sections 3, 4 and *5* of the Guide provide guidance on practical mechanisms that may be employed to ensure the integration of climate change considerations into the EIA process at the national level in the Caribbean and South Pacific regions. Broadly speaking, the process outlined in the guide would be subsumed under the normal EIA process, and therefore would serve as "matters for consideration" or issues to be covered during the EIA process. This approach will ensure that the integration of climate change considerations into the EIA process does not become a costly or cumbersome additional requirement.

It is anticipated that the Guide will be further refined based on feedback from users in the field and on an improvement of our knowledge of the science of climate change. It is hoped that this Guide will develop into an essential tool for Caribbean and South Pacific planners dealing with the identification and implementation of climate change adaptation responses in proposed development activities within their respective regions.

PEER PANEL

This Guide has been developed through a collaborative exercise involving the following climate change, natural hazard and EIA specialists.

AHMAD
Mr. Rafi Ahmad
Lecturer in Geology

Unit for Disaster Studies
Department of Geography and Geology, University of the West Indies (UWI)
Mona, Kingston 7, Jamaica

Tel: (876) 927-2728
Fax: (876) 977-6029
Home Tel: 876-927-2928

Email: rahmad@uwimona.edu.jm

www.uwimona.edu.jm/uds/

BLACK-LAYNE
Ms. Diann Black-Layne
Chief Environment Officer

Ministry of Tourism and Environment
Government Office Complex
Building No 2
St. John's, Antigua and Barbuda

Tel: (268) 462-4625
Fax: (268) 462-6398

Email: dcblack11@yahoo.com

environment@antiguabarbuda.net

CHASE
Dr. Vasantha Chase
Head

Environment and Sustainable Development Unit - Organization for Eastern Caribbean States
P. O. Box 1383
Castries, Saint Lucia

Tel: (758) 453-6208
Fax: (758) 452-2194

Email: oecsnrmu@candw.lc

DIXON
Ms. Cheryl Dixon
Project Officer (Environment)

Caribbean Development Bank
Wildey, St. Michael, Barbados

Tel: 431-1600
Fax: 426-7269

Email: dixonc@caribank.org

DOUGLAS
Novlette Mae Douglas
Programme Specialist

National Environment and Planning Agency

10 Caledonia Avenue
Kingston 5, Jamaica

Tel: (876) 908-2928;
754-7549-50(758)
Fax: (876) 754-7597

Email: ndouglas@nepa.gov.jm

www.nepa.gov.jm

JOHN
Mr. Mark John
Director

Division of Forestry and Wildlife
Ministry of Agriculture and the Environment, Botanical Gardens,
Roseau, Commonwealth of Dominica

Tel: 1-767 448 2401
Fax: 1-767 448 7999

Email: bmjohn75@hotmail.com

JONES
Ms. Eleanor Jones
Managing Director

Environmental Solutions Ltd.
20 West Kings House Road
Kingston 10, Jamaica

Tel: (876) 960-8627/960-0794
Fax: (876) 929-5731

Email: ebj@mail.infochan.com

KUMAR
Ms. Premila Kumar
Senior Environmental Officer

Department of the Environment
P. O. Box 2131
Government Building, Suva
Fiji Islands

Tel: (679) 331 1699
Fax:(679) 331 2879

Email: premila_k@yahoo.com
or epeli_nasome@hotmail.com

MC DONALD
Franklin McDonald
Chief Executive Officer

National Environment and
Planning Agency
John McIntosh Building
10 Caledonia Avenue
Kingston 5, Jamaica

Tel: (876) 754-7526
Fax: (876) 754-7594

Email: fmcdonald@nepa.gov.jm

MOSELEY
Prof. Leo Moseley
Dean of the Faculty of Pure and Applied Sciences

University of the West Indies
Cave Hill, St. Michael, Barbados

Tel: (246) 417-4310
Fax: (246) 417-4597

Email: lmoseley@uwichill.edu.bb

MURRAY
Dr. Reynold Murray
Environmental Services Coordinator

Ministry of Health and
Environment Kingstown
St. Vincent and the Grenadines

Tel: 784-485-6992
Fax: 784-457-2684; 456-1785

Email: carms@caribsurf.com

NAKALEVU
Mr. Taito Nakalevu
Climate Change Adaptation Officer

South Pacific Regional
Environmental Programme
(SPREP)
P. O. Box 240, Apia, Samoa

Tel: (685) 21929
Fax: (685) 20231

Email: taiton@sprep.org.ws

ODERSON
Mr. Derrick Oderson
Environmental Officer

Ministry of Physical Development
and Environment
Frank Walcott Building
Culloden Road,
St. Michael, Barbados

Tel: 246-426-2390
Fax: 246-437-8859

Email: meenr@sunbeach.net

RILEY
Ms. Elizabeth Riley
Programme Manager

Mitigation and Research
Caribbean Disaster Emergency
Response Agency
The Garrison
St. Michael, Barbados

Tel: 246-436-9650
Fax: 246-437-7469

Email: cdera@caribsurf.com;
lizriley@cdera.org

SAMMY
Dr. George Sammy
Environmental Engineer

Ecoengineering Consultants Ltd
62 Eastern Main Road St.
Augustine, Trinidad and Tobago

Tel: 868-663-9812
Fax: 868-662-7292

Email: ecoeng@tstt.net.tt

SIMMONS
Mr. David Simmons
President

Simmons & Associates Inc
#2 Ingleside House, 7th Avenue
Belleville, St. Michael, Barbados

Tel: 246-228-7013
Fax: 246-228-7018

Email: asimmons@sunbeach.net

SINGH
Dr. David Singh
Director - Environmental Management

Environmental Protection Agency
University of Guyana
Turkeyen, Greater Georgetown
Guyana

Tel: 011-59222-22277, 22231
ext 21
Fax: 59222 22442

Email: dsingh@epaguyana.org

www.epaguyana.org

SPRINGER
Mr. Cletus Springer
Principal Consultant

Impact Consultancies Services Inc.
Castries, Saint Lucia

Tel/Fax: 1-758-452-1007

Email: springerc@candw.lc

SQUIRES
Mr. Clairvair Squires
Portfolio Manager

Project Financing Division
Caribbean Development Bank
Wildey, St. Michael, Barbados

Tel: 246-431-1653
Fax: 246-426-7629

Email: squirec@caribank.org
www.caribank.org

THOMAS
Joyce Thomas

Economic Affairs Division
Ministry of Finance
The Carenage
St. George's, Grenada

Tel: 473-440-2101
Fax: 473-440-0075

Email: jthomascalliste@yahoo.com

PROJECT CO-ORDINATORS

Dr. Ulric Trotz
Project Manager

RPIU/ACCC
West Indian Commission Building
Lazaretto, Black Rock
St. Michael, Barbados

Tel: 246-417-4581

Fax: 246-417-0461

Email: trotzcpacc@sunbeach.net

Mr. George de Romilly
Canadian Executing Agency (CEA) Adapting to Climate Change in the Caribbean (ACCC) Program

President - de Romilly & de Romilly Limited

5 Spray Avenue, Mason's Point

St. Margaret's Bay, Halifax
Nova Scotia, Canada B3Z 1Z3

Tel/Fax: 1-902-826-7708

Email: romillyg@istar.ca

Dr. Cassandra T. Rogers
Consultant Project Manager

Disaster Mitigation Facility for the Caribbean
Poverty Reduction and Environment Unit

Caribbean Development Bank,
Wildey, St. Michael, Barbados

Tel: 246-431-1740

Fax: 246-431-1601

Email: rogersc@caribank.org; cassietrogers@yahoo.com

Ms. Judi Clarke
Component Manager

RPIU/ACCC
West Indian Commission Building
Lazaretto, Black Rock
St. Michael, Barbados

Tel: 246-417-4581

Fax: 246-417-0461

Email: clarkecpacc@sunbeach.net

GLOSSARY OF TERMS AND DEFINITIONS

Adaptation
- Adjustment in natural or human systems to a new or changing environment. Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation. (IPCC, *Climate Change 2001: Impact, Adaption and Vulnerability.* TAR, 2001)

Adaptation benefits
- The avoided damage costs or the accrued benefits following the adoption and implementation of adaptation measures. (*Climate Change 2001: Impacts, Adaptation and Vulnerability.* IPCC TAR, 2001)

Adaptation costs
- Costs of planning, preparing for, facilitating, and implementing adaptation measures, including transaction costs. (*Climate Change 2001: Impacts, Adaptation and Vulnerability*. IPCC TAR, 2001)

Adaptive capacity
- The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or cope with the consequences. (*Climate Change 2001: Impacts, Adaptation and Vulnerability.* IPCC TAR, 2001)

ACCC
- Adapting to Climate Change in the Caribbean - CIDA funded program 2001-2004

Baseline Information
- A description of existing environmental, social and economic conditions at and surrounding an action.

Cause-effect Relationship
- The connection between an action's disturbance (cause) and its effect on the environment.

Combined Effects
- The effects caused by various components of the same action.

CCCCC
- Caribbean Community Climate Change Centre (www.caribbeanclimate.org)

CARICOM
- Caribbean Community

Climate change
- A change of climate attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. (UNFCCC)

Climate scenario
- A projection of future climatic conditions.

Climate variability
- Fluctuations in climate over a shorter term - the departures from long-term averages or trends, over seasons or a few years, such as those caused by the El Niño Southern Oscillation phenomenon.

Consequences
- Risk is often expressed as the product of the consequences flowing from an event and the frequency of the event. In this Guide, the term "impacts" is used for consistency with the terminology of climate change.

Cumulative Effects Assessment
- An assessment of the incremental effects of an action or event on the environment when the effects are combined with those from other past, existing and future actions/events.

Disaster
- A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community/society to cope using its own resources. A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk.

EIA
- Environmental Impact Assessment

EIA Administrator
- Individual designated or responsible for administering the environmental impact assessment process for, or on behalf of any government or any approval authority.

El Niño-Southern Oscillation (ENSO)
- An irregularly occurring pattern of abnormal warming of the surface coastal waters off Ecuador, Peru and Chile. This coupled atmosphere-ocean phenomenon is associated with the fluctuation of intertropical surface pressure pattern and circulation in the Indian and Pacific oceans, called the Southern Oscillation. A number of attempts have been made to define El Niño, both quantitatively and qualitatively, but none has achieved universal recognition. This phenomenon triggers a shift in seasonal patterns of weather systems over many subtropical and mid-latitude parts of the globe. **La Niña** is the opposite of an El Niño event, during which waters in the west Pacific are warmer than normal and trade winds are stronger.

Environmental Components
- Fundamental elements of the natural and human environment; examples include: social, air, water, soils, terrain, vegetation, wildlife, fish, avifauna and land use.

Evaluation
- The determination of the significance of effects. Evaluation involves making judgements as to the value of what is being affected and the risk that the effect will occur and be unacceptable.

Frequency
- The number of occurrences of an event within a specific period of time.

Green-house Gases
- Defined to be: carbon dioxide (CO_2), carbon monoxide (CO), nitrous oxide (N_2O), oxides of nitrogen (NOx), methane (CH_4), and non-methane volatile organic compounds (NMVOCs). The *Kyoto Protocol* also addresses hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF6).

Hazard
- A source of potential harm, or a situation with a potential for causing harm, in terms of human injury; damage to health, property, the environment, and other things of value; or some combination of these.

Hazard Identification
- The process of recognizing that a hazard exists and defining its characteristics.

Impact
- Something that logically or naturally follows from an action or condition related to climate change or climate variability.

IPCC
- Intergovernmental Panel on Climate Change

Likelihood
- The degree of certainty of an event occurring. Likelihood can be stated as a probability.

Loss
- An injury or damage to health, property, the environment, or something else of value.

Magnitude
- A measure of how adverse or beneficial an effect may be.

Mitigation
- Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards. In the context of climate change, mitigation means a human intervention to reduce the sources or enhance the sinks of greenhouse gases (*Climate Change 2001: The Scientific Basis.* IPCC TAR, 2001)

Monitoring
- A continuing assessment of conditions at and surrounding the action. This determines if effects occur as predicted or if operations remain within acceptable limits, and if mitigation measures are as effective as predicted.

Organization
- A company, corporation, firm, enterprise, or institution, or part thereof, whether incorporated or not, public or private, that has its own functions and administration.

Pathway Diagram
- A simple diagrammatic representation of a cause-effect relationship between two related states or actions that illustrates an impact model. Pathway diagrams take network diagrams one-step further by evaluating each linkage and assessing the cause-effect relationship in the context of a scientific hypothesis.

Pathway
- A series of consecutive valid linkages in a Pathway Diagram.

Qualitative Analysis
- Analysis that is subjective (i.e., based on best professional judgement).

Quantitative Analysis
- Analysis that uses environmental variables represented by numbers or ranges, often accomplished by numerical modelling or statistical analysis.

Resilience / resilient
- The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure This is determined by the degree to which the social system is capable or organising itself to increase this capacity for learning from past disasters for better future protection and to improve risk reduction measures.

Risk
- The chance of injury or loss as defined as a measure of the probability and severity of an adverse effect to health, property, the environment, or other things of value.

Risk analysis
- The systematic use of information to identify hazards and to estimate the chance for, and severity of, injury or loss to individuals or populations, property, the environment, or other things of value.

Risk assessment
- The overall process of risk analysis and risk evaluation.

Risk communication
- Any two-way communication between stakeholders about the existence, nature, form, severity, or acceptability of risks.

Risk management
- The systematic application of management policies, procedures, and practices to the tasks of analysing, evaluating, controlling, and communicating about risk issues.

Risk perception
- The significance assigned to risks by stakeholders. This perception is derived from the stakeholders' expressed needs, issues, and concerns.

Risk scenario
- A defined sequence of events with an associated frequency and consequences.

SPREP
- South Pacific Regional Environment Program

Stakeholder
- Any individual, group, or organization able to affect, be affected by, or believe it might be affected by, a decision or activity. The decision-maker(s) is/are a stakeholder(s).

TAR
- Third Assessment Report of the IPCC

UNFCCC
- United Nations Framework Convention on Climate Change

Valued Ecosystem Component
- Any part of the environment that is considered important by the proponent, public, scientists or government involved in the assessment process. Importance may be determined on the basis of cultural values or scientific concern.

Vulnerability
- The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is the function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity. (*Climate Change 2001: Impacts, Adaptation and Vulnerability*. IPCC TAR, 2001)

SECTION 1 Introduction

1.0 Background

This guide has been developed to assist CARICOM and SPREP country practitioners in the integration of climate change adaptation into the environmental impact assessment (EIA) process. The guidance document constitutes one element of the *Guide to the Integration of Natural Hazards into the Environmental Impact Assessment Process* that has been developed in collaboration with the Caribbean Development Bank (CDB) under the Disaster Mitigation Facility for the Caribbean (DMFC) program.

The methodology employed in this Guide is based, in part on the World Bank's EIA procedures (see *Environmental Assessment Sourcebook*) in addition to common elements of environmental impact assessment processes and procedures employed in the Caribbean region as summarised in *Review of Environmental Impact Assessment in Selected Countries of Latin-America and the Caribbean* (Inter-American Development Bank, 2001). The Guide is to be used in conjunction with other decision-making "tools" including regional climate scenarios and models, and the *Risk-Management Guide for Climate Change Adaptation Decision-Making* (ACCC, July 2003).

1.1 Why Do We Need a Guide on the Integration of Climate Change into the EIA Process?

One of the major environmental challenges facing Caribbean and South Pacific island and coastal developing States is that of global climate change (see *Section 1.3.*) and increased climate variability that affects many aspects of island/coastal life and economy - human settlements, agriculture, water availability, health, the coastal zone, tourism and, of course, the frequency and severity of disasters from storms, floods and droughts. The importance of the Environmental Impact Assessment (EIA) process as an effective instrument for climate change adaptation planning and management has been identified in the United Nations Framework Convention on Climate Change (UNFCCC). However, it has also been recognized that environmental impact assessments cannot adequately serve as an instrument for adaptation planning and management since currently, assessments do not involve the consideration of climate change impacts on proposed activities. Under existing EIA processes the impacts of climate change on the sustainability of construction or other long-term infrastructure projects are not assessed. Additionally, ecological and socio-economic evaluations undertaken during environmental assessment do not require a review of climate change impacts and possible adaptation programs, and no evaluation is undertaken as to whether institutional programs enhance adaptive capabilities.

1.2 Climate Variability and Change – The Challenge for the EIA Process

Many projects for which EIA's are required have relatively long life spans, twenty to hundreds of years. This includes the construction of buildings,

highways, port and harbour facilities and physical infrastructure of all kinds. Thus, it is important to consider how changing climate will influence the project and how the project will affect nearby resources, society and environment under future conditions, not just those of the present.

One of the most compelling reasons for considering climate change in EIAs is that every project is designed with some assumption about the climate in which it will function. The conventional way is to assume that the climate of the past is a reliable guide to the future. *This is no longer a good assumption*. Thus design criteria must be based on probable future climate, that is climate change over the life of the project. Accordingly, Environmental Impact Assessments of projects and activities should consider not only the effects on emissions or sequestration of greenhouse gases, (e.g., energy or reforestation projects), but also the impacts of impending climate-related changes on the project or activity. *In addition to an evaluation of the impacts of the project on the environment – which is the traditional practice – the EIA process must also consider the impacts of the ever-changing environment on the project.*

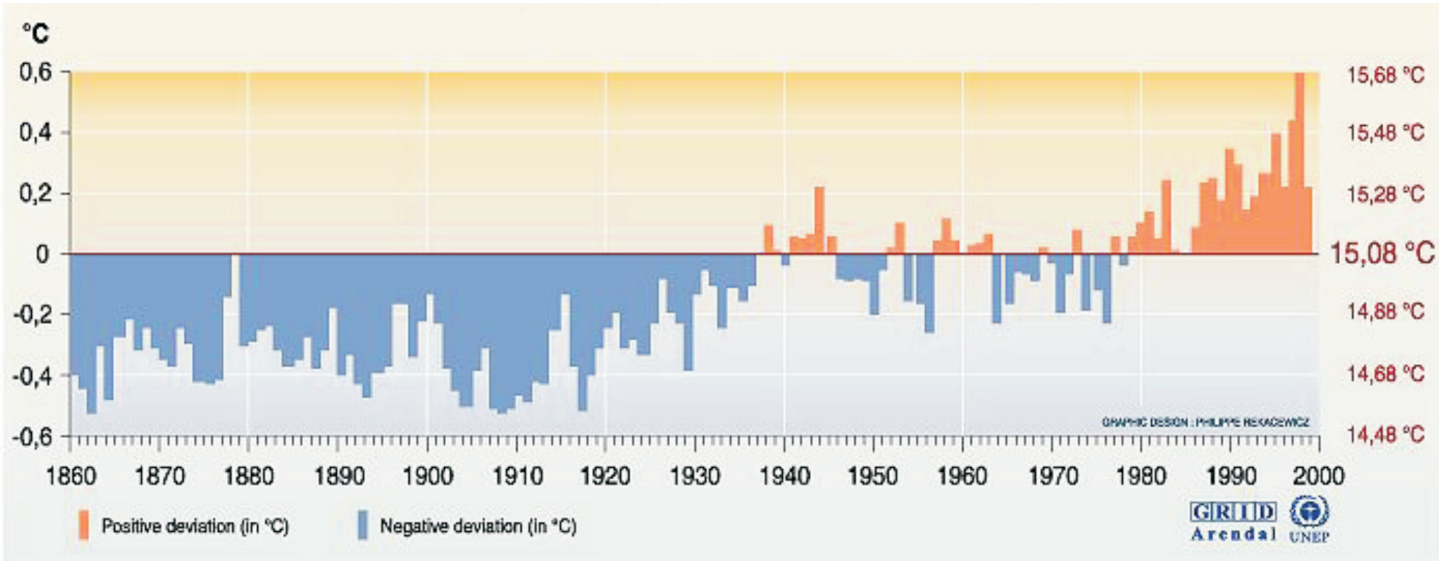
1.3 What is Climate Change?

Global, regional and local climate has changed greatly over millions of years. Scientific evidence highlights that for the last several thousand years, to about 1900, our planet has enjoyed relatively stable climates, with only very minor changes in the global mean temperature.

However, the advent of the industrial revolution in the 1800's, and removal of vast areas of forests for agriculture and human habitation, has unbalanced the complex natural climate system. In particular, burning of fossil fuels, and to a lesser extent loss of forests, have resulted in a rapid increase of what are termed "greenhouse gases" that also occur naturally in the atmosphere, particularly carbon dioxide. Greenhouse gases have the effect of reducing the amount of energy earth sends back to space, although allowing the usual amount of energy from the sun to penetrate to the earth. This combination warms the surface of the planet. (see *Figure 2*)

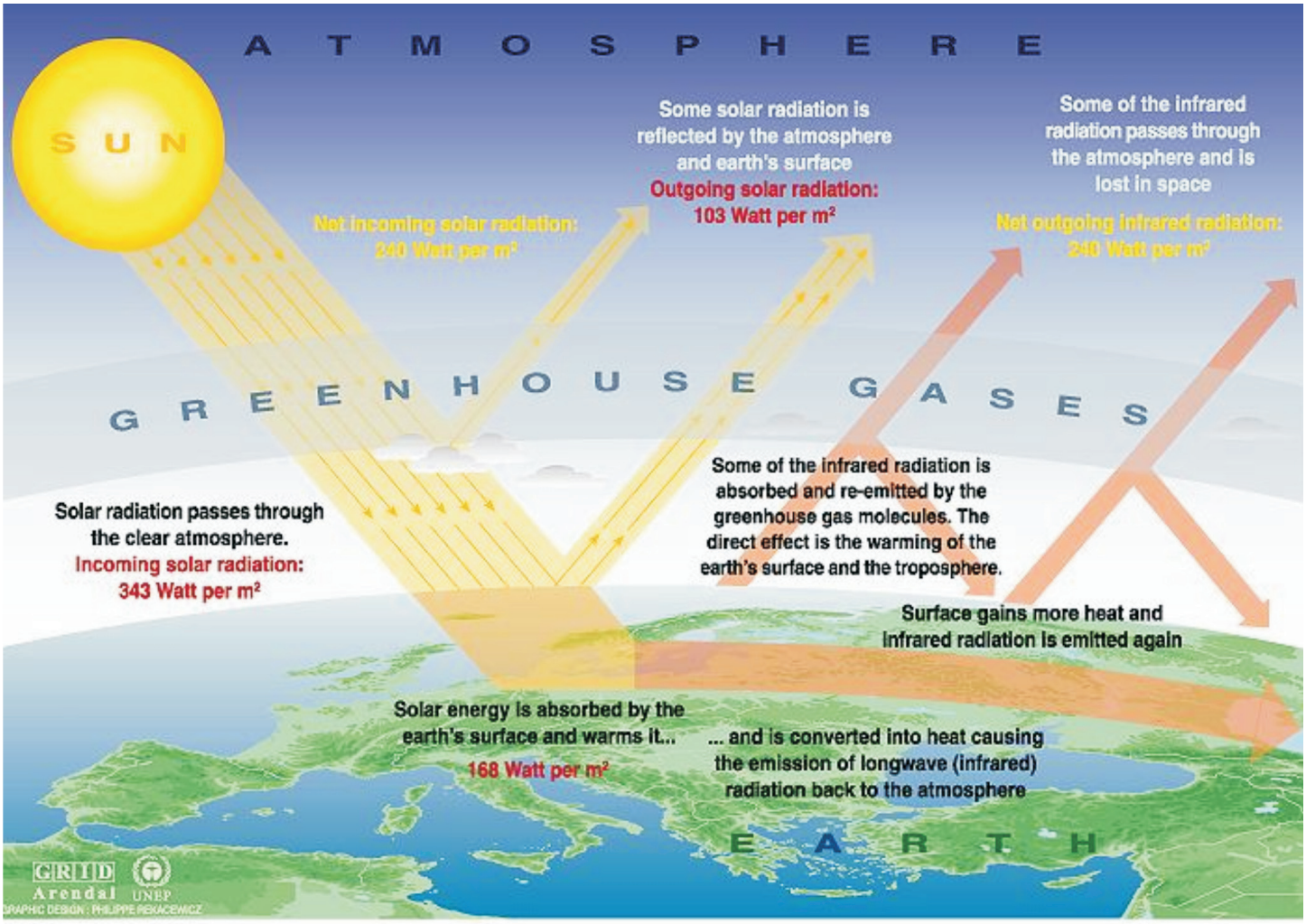
The basic understanding of how human activities can warm the earth in this way has been known since the late 1800's (Fourier, Arrhenius). However, it is only in the past few decades that high speed computers have permitted the mathematical modelling of the climate system (air, ocean, vegetation, land and water surfaces) to provide reasonable quantitative estimates of changes in temperature, precipitation, storms and other climatic factors with past and projected increases in greenhouse gases. In addition, it has become clear that the global warming of the past 50 years, particularly the 30 years to 2000

FIGURE 1 - Trends in Global Average Surface Temperatures



Source: School of Environmental Sciences, Climate Reseach Unit, University of East Anglia, Norwich, United Kingdom, 1999.

FIGURE 2 - The Greenhouse Effect



Sources: Okanagan university college in Canada, Department of geography, University of Oxford, school of geography; United States Environmental Protection Agency (EPA), Washington; Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.

AD has been caused by these human activities. The carbon dioxide equivalent concentration in the atmosphere (converting other greenhouse gases to CO_2 equivalent and adding to CO_2 itself) at the turn of this century were the highest in earth's atmosphere in the past 250,000 years and some ice core measurements suggest in the past 20 million years.

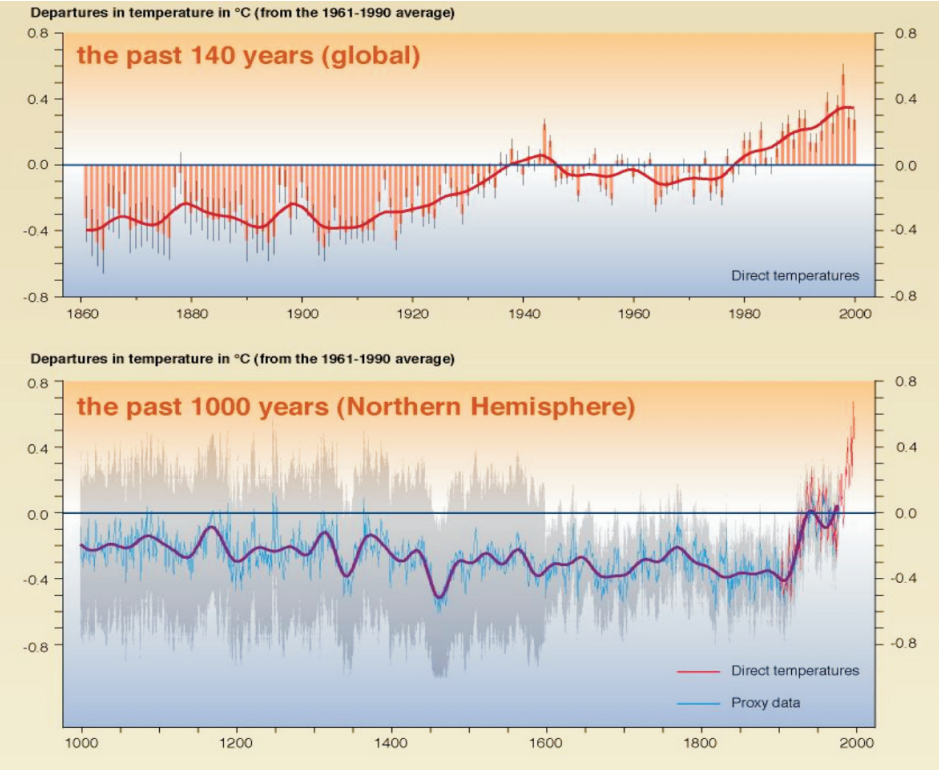
1.4 What are the Likely Impacts from Global Climate Change?

Several United Nations agencies, led by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP), in response to requests from many countries, established in 1988 the Intergovernmental Panel on Climate Change (IPCC). This Panel was charged with summarising from the extensive available scientific literature, the state of knowledge of anthropogenic climate change.

IPCC has produced three authoritative main reports (in 1990, 1995 and 2001) involving several thousand climate scientists and economists from more than 70 countries. These main findings have been endorsed by the National Academies of Science of 20 countries.

The IPCC identifies what is known, what is only partially known, and what are the main remaining uncertainties. One uncertainty in projecting future climate lies in estimating the future emissions of greenhouse gases which depend on future

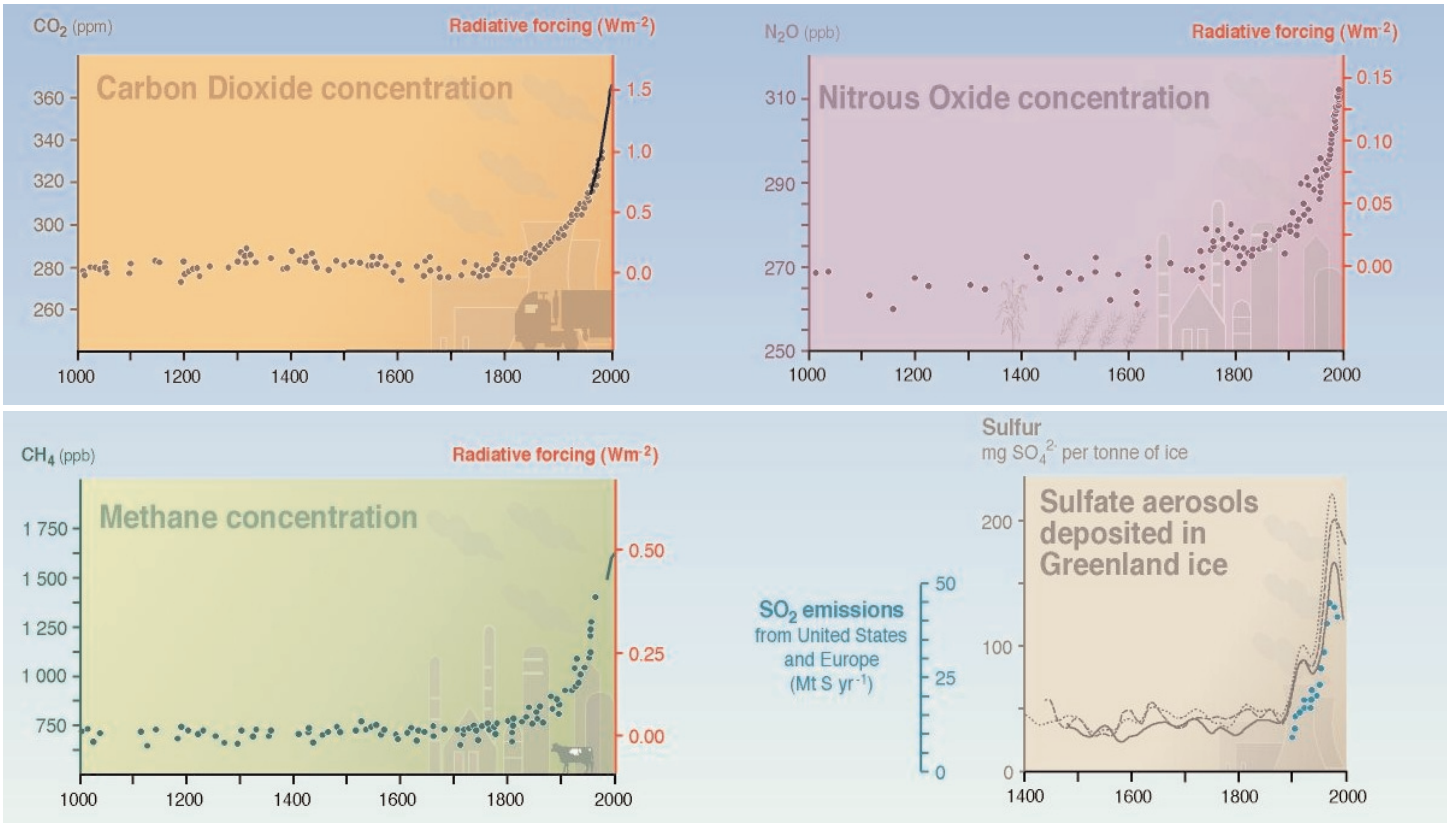
FIGURE 3 - Variations of the Earth's Surface Temperature



Souce: IPCC Intergovernmental Panel on Climate Change

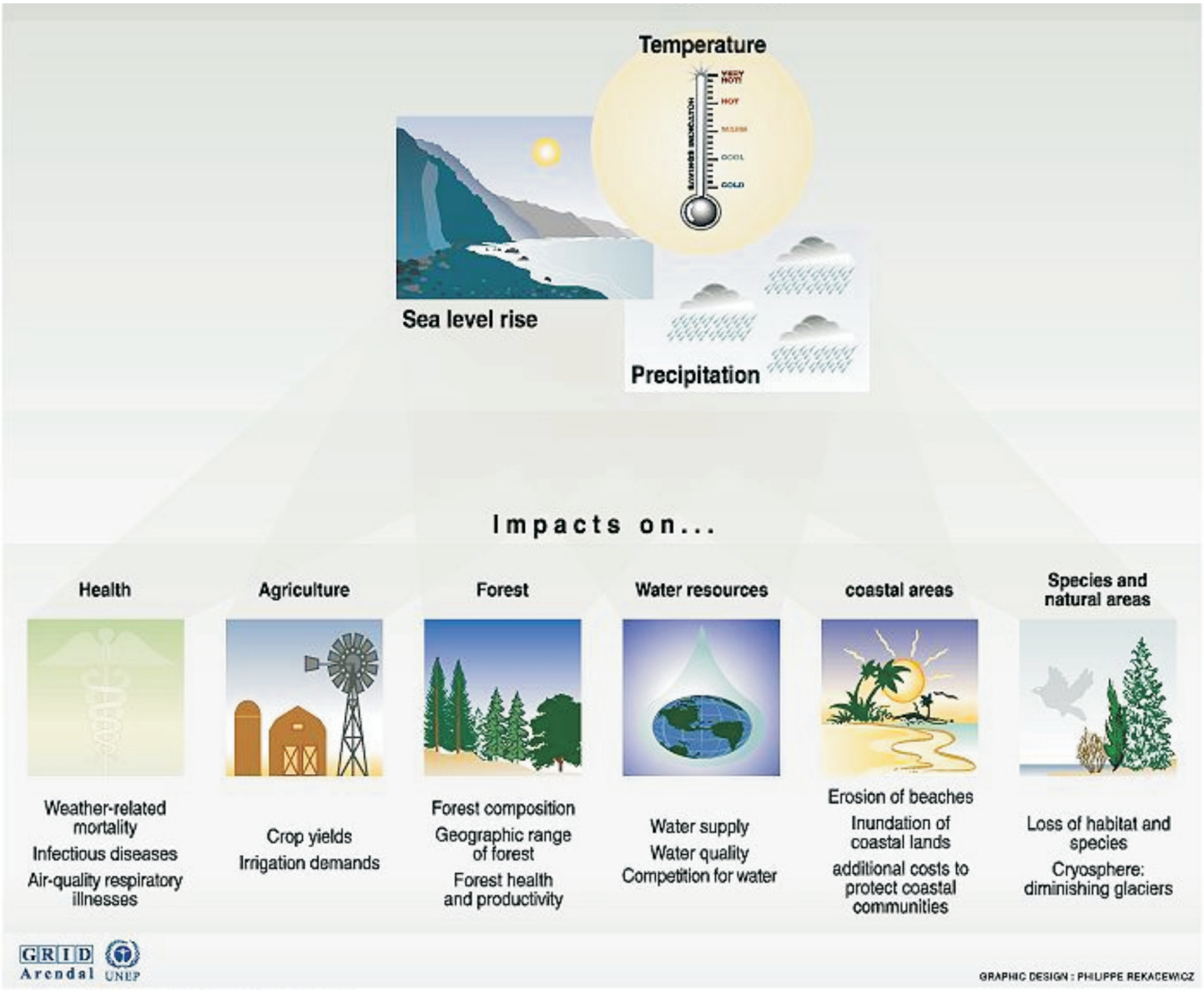
energy sources, economic and population growth rates – all of which are uncertain. The different results from the dozen or so Atmosphere-Ocean Global Climate Models lends a second uncertainty. For a given emission scenario, the models are fairly consistent in amount of warming projected, precipitation changes and sea level rise (due to thermal expansion of sea water and melting of glaciers), on a global scale. However, they show much larger differences on a regional or local scale. These differences are due to the different ways each model expresses in mathematical form the many physical chemical and biological processes involved. The main findings of the most recent *IPCC Report 2001*, are given in *Figure 6*.

FIGURE 4 - Indicators of the Human Influence on the Atmosphere During the Industrial Era



Souce: IPCC Intergovernmental Panel on Climate Change

FIGURE 5 - Potential Climate Change Impact



Source: United States environmental protection agency (EPA).

Humanity's greenhouse gas emissions are expected to lead to climatic changes in the 21st century and beyond. These changes will potentially have wide-ranging effects on the natural environment as well as on human societies and economies. Scientists have made estimates of the potential direct impacts on various socio-economic sectors, but in reality the full consequences would be more complicated because impacts on one sector can also affect other sectors indirectly. To assess potential impacts, it is necessary to estimate the extent and magnitude of climate change, especially at the national and local levels. Although much progress has been made in understanding the climate system and climate change, projections of climate change and its impacts still contain many uncertainties, particularly at the regional and local levels.

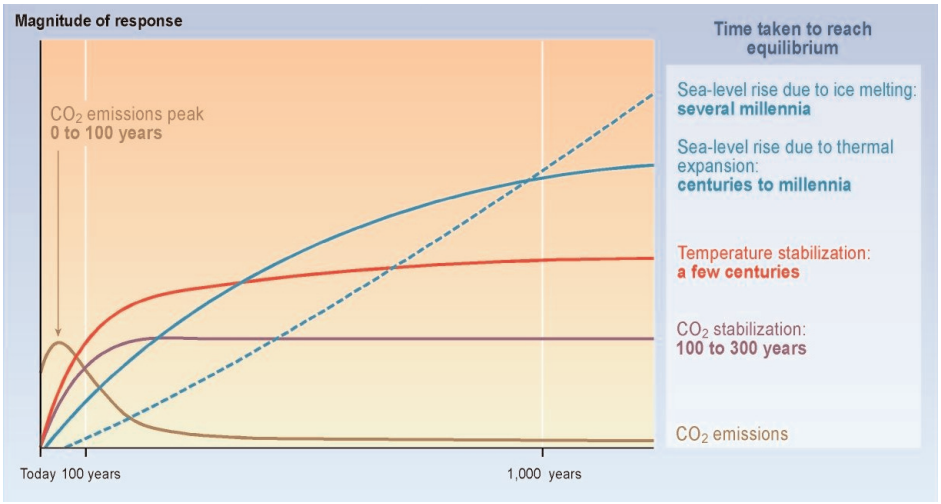
Techniques have been developed to take the global climate model outcomes for a given future date and "downscale" these to a specific area to provide a range of estimates of future climatic factors. Such techniques fall into two categories: statistical methods and dynamical approaches. The

FIGURE 6 - IPCC Third Assessment Report (TAR) 2001

KEY MESSAGES

- Global average sea level rose between 0.1 and 0.2 m last century and is projected to rise 0.1 to 0.9 m this century (see TAR for full range of emission Scenarios)
- Northern Hemisphere temperature increase last century was largest in past 1000 years.
- There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities.
- Human influences will continue to change atmospheric composition throughout the 21st century.
- Globally, average surface temperatures are projected to increase by 1.4 to 5.8^{0}C from 1990 to 2100 (higher than 1.0 to 3.5^{0}C predicted in the Second Assessment Report).
- For Caribbean and Atlantic islands an increase of 2.6^{0}C (ensemble mean of models) in average surface temperatures are projected.
- There is "very high" or "high" confidence that some extreme events have increased in frequency and intensity and will continue to do so.
- A diverse set of physical and biological systems have already been affected by climate change.
- Changes in climate extremes (especially hurricanes) have major consequences.
- Coastal areas will experience increased flooding, erosion, loss of wetlands and mangroves, and sea-water intrusion into estuaries and aquifers. Future sea surface warming will increase stress on coral reefs and frequency of marine-transmitted diseases.
- Adaptation measures can lessen vulnerability.
- A key misconception is that all adaptation is a task carried out by governments. For Small Island States long exposed to climatic hazards, adaptation should incorporate traditional coping skills.
- A large portfolio of energy efficiency and non-fossil energy technologies are available – Renewable energy in Small Island States is a "Win-Win" strategy.
- Costs of implementing the Kyoto Protocol in OECD countries are estimated at 0.2 to 2% of GDP without emission trading, but only half that with a full trading regime.

FIGURE 7 - $C0_2$ Concentration, Temperature and Sea-Level Continue to Rise Long After Emissions are Reduced



Souce: IPCC Intergovernmental Panel on Climate Change

latter attempts to build regional models "nested" in the global models to better take into account topographic, water-land interface and other factors that affect local and regional climate. However, the science to do this well is still evolving and as of 2002, statistical techniques are generally more useful.

1.5 What are the Likely Impacts from Global Climate Change in the Caribbean Region?

Although there is much climatic variation between localities, some factors and characteristics are common to most small islands – mainly as a result of their insular nature and tropical location. For instance, it is generally true that:

- The ocean exerts a strong influence on the climate of islands.

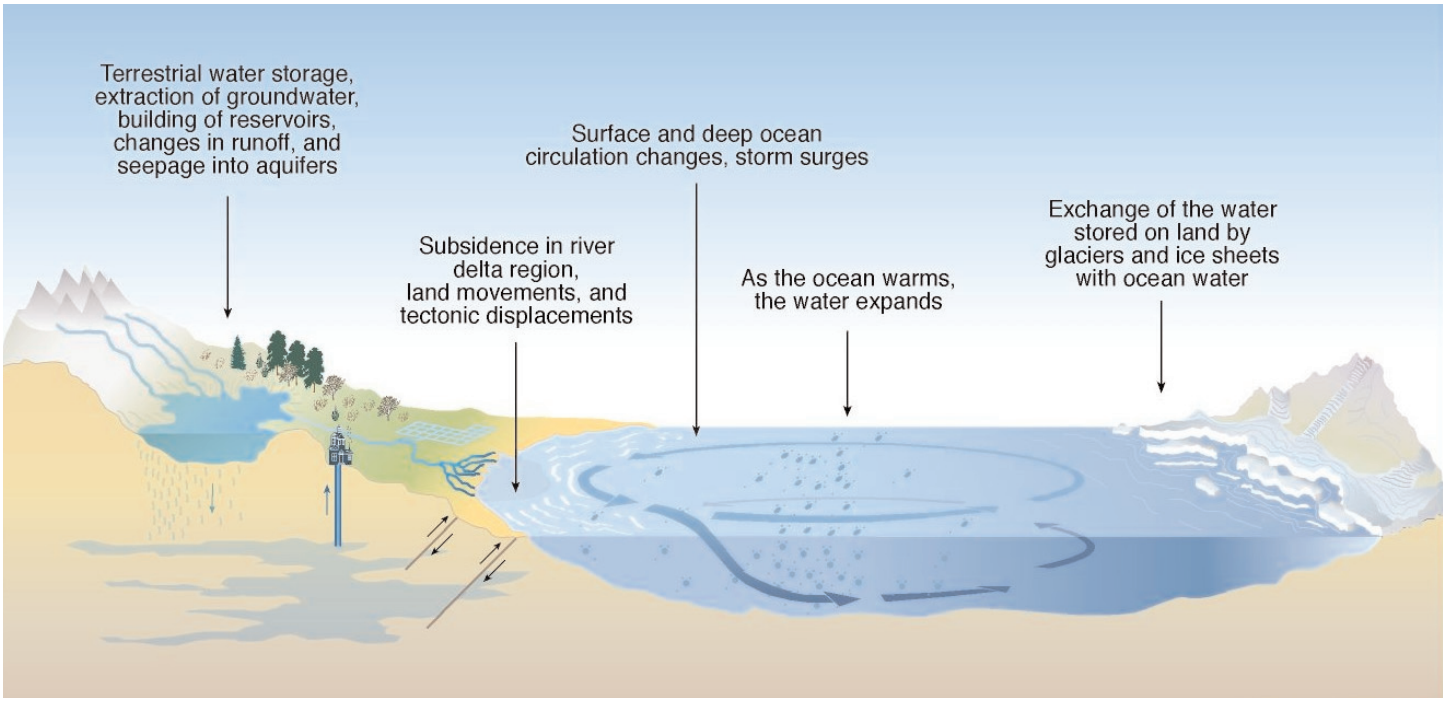
- Temperatures now are usually high, with mean annual values of 20°C and above.
- Diurnal and seasonal variations in temperature are low, with ranges around 5°C and less.
- Small island Caribbean states are strongly affected by tropical storms and hurricanes.

Average annual temperatures have increased by at least 0.5°C over the period 1900-1995, and in some Caribbean countries by 1°C or more. Seasonal temperature data are consistent with the higher average temperatures. Rainfall data for the same period show much greater seasonal, inter-annual, and decadal-scale variability, although a declining trend in average annual rainfall – on the order of 250 mm in some locations – is evident.[1] Annual rainfall varies considerably across the CARICOM countries from 750 to 1400 mm in Grenada to 1270 to 7620 in Dominica. High inter-annual and sub-decadal variations of tropical storms are evident.

Most small islands are too small to be identified with a grid point in global climate models. This limits the ability to generate future projections of climate change for individual small islands. However, some projected effects are regionally robust. *Surface air temperatures can be expected to rise* in the future. Because oceans are expected to warm in the future, albeit at a slower rate than land masses, small island states are also expected to experience *moderate warming*.[2]

Models do not all agree on the future changes to annual precipitation in the Caribbean, although most show drying conditions. Recent records show trends towards *increasing precipitation in the northern Caribbean*, for example northern Bahamian Islands; and less in the southern Bahamas and in most countries as far south as Suriname. Evaporation generally rises with temperature, but also depends on other factors including vapour pressure, so evaporation rates will vary spatially and temporally within the region, but less so than rainfall. Several models project an *increase in precipitation intensity and flash flooding* for latitudes within which many small island states are located. This effect has already been observed over the past few decades in the Caribbean. *Increases in the incidence of drought* also have been projected. *Sea level rise* varies with factors such as the rate of warming, the efficiency of ocean circulation, and local atmospheric

FIGURE 8 - What Causes the Sea - Level to Change?



Souce: IPCC Intergovernmental Panel on Climate Change

[1]Nurse, et al., 1998, p. 339.

[2]Nurse, et al., 1998, p. 340.

effects, and currents, and hence is not uniform.

Recognizing that while there is general agreement on trends and global effects, there will always be uncertainty in projections of future climate for a given location, "risk management" techniques have been developed with climate change applications specifically in mind.[3] These techniques systematize the process of considering the vulnerability of a location or project to changing climate and related rising sea level, and assessing adaptation options in light of a range of climate outcomes and their probability of occurrence within a given time period. It is recommended that these techniques, originally developed for businesses and modified for climate change considerations, be used in the development of project relevant climate scenarios for any EIA process (see *Section 2*). A summary of climate change scenarios for the Caribbean region is provided in *Annex 1*.

1.6 What are the Likely Impacts from Climate and Sea-level Variability and Change in the South Pacific Island States?[4]

Pacific Island Countries are already experiencing the adverse effects of a changing climate, and are the first to be forced to adapt. Most countries are already experiencing disruptive changes consistent with many of the anticipated consequences of global climate change, including extensive coastal erosion, droughts, coral bleaching, more widespread and frequent occurrence of mosquito-borne diseases, and higher sea levels making some soils too saline for cultivation of traditional crops. Rice yields have been shown to decline with higher temperatures.

While much attention is focused on global warming causing gradual, long-term changes in average conditions, the most immediate and more significant impacts are likely to arise from changes in the nature or frequency of extreme events (e.g., flooding, tropical cyclones, storm surges) and climatic variability (e.g., drought, storm winds accelerating coastal erosion). Present problems resulting from increasing demand for water, and from current patterns of extreme events and climate variability, dwarf those which will result from climate change over the next few decades in all but a few countries in the Pacific Islands Region. Examination of the impacts of climate extremes and variability, including those associated with seasonal and inter-annual phenomena, offers valuable insight into the likely potential effects of climate change on agriculture. Given that in the Pacific Islands Region most good quality land is already under intense cultivation, increasing population numbers combined with climate change impacts will threaten food security, as will the increasing reliance on imported food and the consequential vulnerability to short-term breaks in supply and world food shortages due to climate events.

Even though terrestrial and freshwater ecosystems have been able to evolve and adapt over time to both climate extremes and variability, and to human pressures, there are indications that changes in climatic conditions coupled with unsustainable use will render terrestrial and freshwater ecosystems increasingly vulnerable in the longer term. Many of the likely impacts of climate change on coastal zones and marine ecosystems are already familiar to island populations, and some have experience in coping with them. However, in most countries and for most coastal and marine areas, coping with climate extremes and variability will be of more significance over the next few decades.

The impacts of climate variability and change on human health are most likely to be adverse in nature, and frequently will arise through initial impacts on ecosystems, infrastructure, the economy and social services. For example, economic hardship resulting from the diverse but collective impacts of climate variability and change may well become one of the key factors exacerbating and perpetuating impacts on human health. Poverty is likely to contribute to most if not all health impacts and to the reduced capacity and ability of individuals and communities to cope with them.

[3]References: CHARM and *Caribbean Risk Management Climate Change Guidelines for Adaption Desision Making* (2003)

[4]Adapted from John, H., Mimura, N., Campbell, J., Fifita, S., Koshy, K., McLean, R.F., Nakalevu, T. Nunn, P., and N. Wet. 2002. *Climate Variability and Change and Sea-level Rise in the Pacific Islands Region. A Resource Book for Policy and Decision Makers, Educators and other Stakeholders*. South Pacific Regional Environment Programme and the Ministry of the Environment, Japan. Marfleet Printing, Apia, Samoa.

The growing "urbanness" and centralization of Pacific Island populations is increasing the likelihood of adverse impacts from climate variability and change, while repairs and rehabilitation for rural populations after an extreme event may well receive decreasing priority. The possibility of more extreme events such as tropical cyclones and storm surges, coupled with currently projected rates of sea-level rise and flooding, places critical infrastructure such as health and social services, airports, port facilities, roads, vital utilities such as power and water, coastal protection structures and tourism facilities at increased risk. A high island such as Viti Levu (Fiji) could experience average annual economic losses of $US23 to 52 million by 2050, equivalent to 2 to 4% of Fiji's GDP. A low group of islands, such as Tarawa atoll, could face average annual damages of $US8 to 16 million by 2050, as compared to a current gross domestic product (GDP) of $US47 million. These indicative costs could be considerably higher in individual years when extreme events such as cyclones, droughts or significant storm surges occur.

FIGURE 9 - Potentially Hazardous Natural Phenomena Associated with Climate Change and Climate Variability

ATMOSPHERIC
- Increases in Ultra Violet (U.V.) penetration with ozone layer depletion
- Increased (or variation in) temperature
- Hailstorms and intense rains
- Lightning
- Tropical storms (wind and rain) and Hurricanes

HYDROLOGIC
- INCREASED (OR VARIABILITY IN) PRECIPITATION
  - Flooding (river and coastal)
  - Erosion and sedimentation
  - Storm surges
- DECREASED (OR VARIABILITY IN) PRECIPITATION
  - Desertification
  - Salinization
  - Drought
  - Wildfire (Brush, Forest, Grass, Savannah)

HYDRO-METEOROLOGICAL
- Debris avalanches
- Increased erosion
- Landslides and Rock falls
- Submarine slides
- Subsidence

SEA-LEVEL RISE
- Coastal Inundation
- Increased Storm Surge Impacts

1.7 What Natural "Hazards" are Associated with Climate Change?

As noted above, the natural "hazards" associated with climate change include floods and droughts associated with changing rainfall patterns, coastal inundation associated with sea-level rise, and impacts from extreme events (storms and hurricanes). A summary of potentially hazardous natural phenomena associated with climate change are summarised in *Figure 9*. An explanation of some of the key natural hazards associated with climate change and climate variability is provided in *Annex 2*.

1.8 Do All Impacts from Climate Change Constitute a "Natural Hazard"?

It must be recognized that not all climate change impacts can be termed "hazards" – for example changes to ecosystem biodiversity and impacts on the resilience of natural ecosystems. All climate change related impacts – whether natural hazards or not – should be considered as part of the EIA process (e.g., the spread of infectious disease in humans, animals and plants). Additionally, special consideration should be given to the issue of "cumulative impacts" (see *Section 3*). For example, several seasons of drought followed by an incident of heavy rain can result in flooding, landslides and other hazards.

1.9 Climate Change Hazard Management, Development Planning and EIAs

It is recognised that climate change considerations need to be integrated into all elements of natural hazard management, and that to be effective such considerations should become an integral part of the physical planning process. It is important in particular to distinguish between the "EIA Process" and the "Physical Planning Process" since both terms have different meanings. The term "EIA process" covers a variety of tools including project level EIAs, Strategic and Sectoral EIAs, country level E.A, Environmental Audits and Appraisals. The "Physical Planning Process" covers the whole gamut from policy, legislative and administrative framework to project specific elements within that framework which will include project specific EIA's used as a planning tool. Both processes will offer different entry points for natural hazard vulnerability/ climate change risk assessments that will therefore determine the nature, level and degree of vulnerability and risk assessment to be carried out. *This Guide is limited to the integration of climate change considerations into the EIA process.*

The following section of the Guide outlines the process whereby climate change considerations and adaptation planning can be integrated into the EIA process within CARICOM and SPREP countries. The Guide has attempted to address the needs of diverse users (e.g., EIA administrators, EIA consultants, development financial institutions, commercial banks, private developers) who all come to the table with different needs, and have different flexibility in how they will, or can utilise the Guide to prepare sound projects.

SECTION 2 Intergrating Climate Change Adaptation into EIAs

2.0 Overview of the EIA Process

The purpose of an environmental impact assessment (EIA) is to ensure that the development options under consideration are environmentally sound and sustainable, and that any environmental consequences are recognized early in the project cycle and taken into account in project design (World Bank). EIAs identify ways of improving projects environmentally, and minimizing, mitigating, or compensating for adverse impacts. The process also provides a formal mechanism for inter-agency coordination and for addressing concerns of affected groups and local non-governmental organizations (NGOs).

EIA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project, and when considering the anticipated impacts of climate change, the ***potential environmental impact on the proposed project***. EIA should take into account the natural environment (air, water, and land), and changes to the natural environment brought about by climate change; human health and safety and anticipated impacts to human health and safety from climate change; social aspects (involuntary resettlement, indigenous peoples, and cultural property) and anticipated impacts from climate change; and transboundary and global environmental aspects.

The EIA process evaluates a project's potential environmental risks and impacts in its area of influence; identifies and evaluates potential impacts from the proposed project on the project's area of influence; examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts, and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. The key steps in the environmental impact assessment process are outlined in *Figure 10*.

2.1 Climate Change and the EIA Process

Every project is designed with some assumption about the climate in which it will function. *The conventional way is to assume that the climate of the past is a reliable guide to the future. This is no longer a good assumption.* Thus design criteria must be based on probable future climate, that is climate change over the life of the project. Accordingly, Environmental Impact Assessments of projects and activities should consider not only the effects of the project on the environment, *but also the impacts of impending climate-related changes on the project or activity* (i.e., the impacts of the environment on the project). Potential risks can be identified for each of these sectors. To determine the risks to which sectors are exposed it is necessary to examine their vulnerability to specific hazards.

Potential hazards expected from climate variability and climate change include:

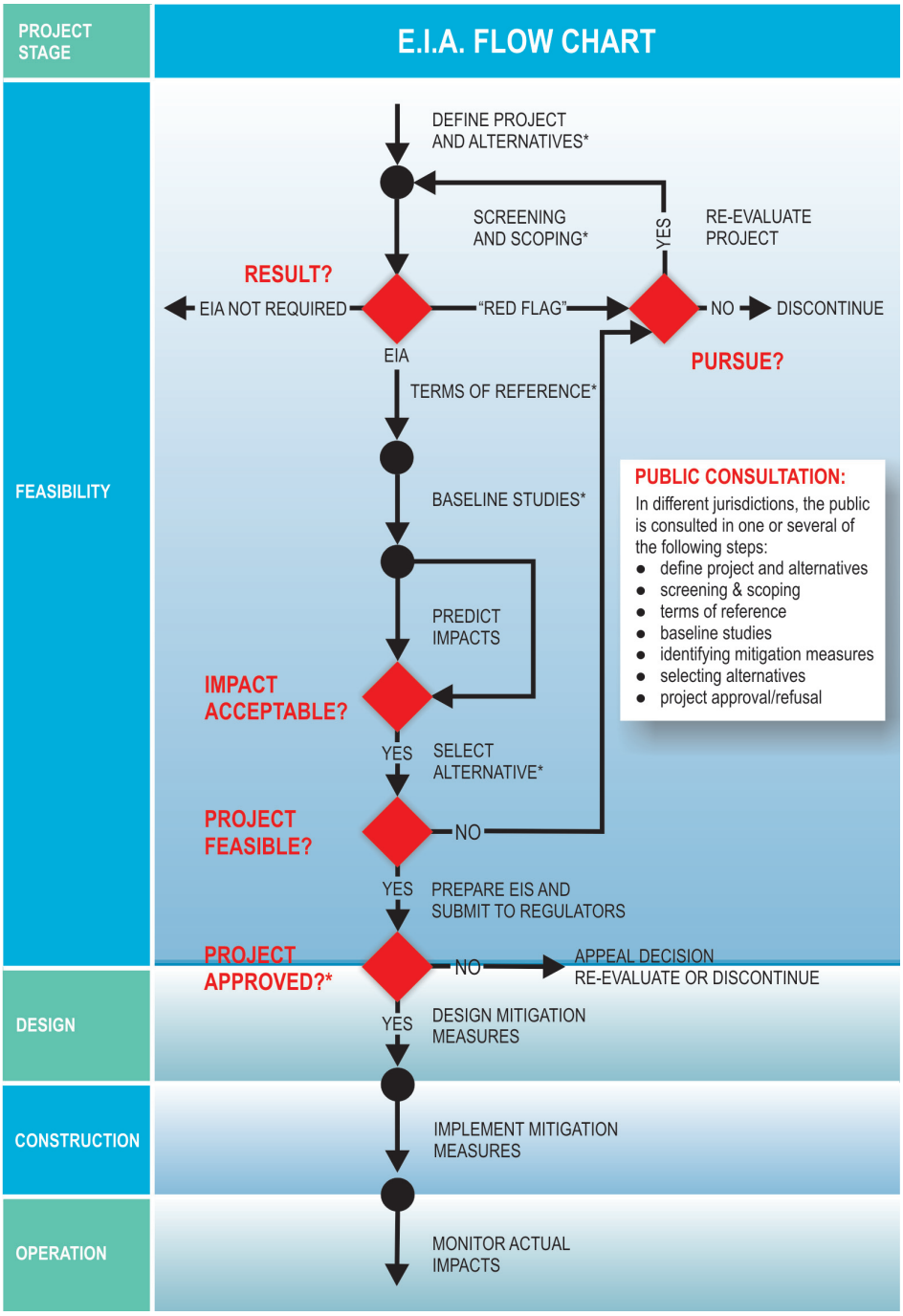
- Increased surface temperatures
- Decreased precipitation
- More frequent and intense storms[1]
- Changing weather patterns
- Sea level rise
- Changes in ultra-violet penetration levels.

Among the sectors with greatest vulnerability are:

- Tourism (temperature changes in region and abroad, sea level rise, water availability)
- Coastal area infrastructure (sea level rise, more severe storms)
- Housing and other infrastructure (heavier, short duration rains and storms, water availability)
- Agriculture (higher temperatures, changes in rainfall, more CO_2 in atmosphere)
- Water resources (greater evaporation, changes in rainfall, increasing demands in warmer climate, salt water intrusion with sea level rise
- Human Health (greater risks of vector borne and water borne diseases, greater heat stress, and exposure to ultra-violet radiation)
- Biodiversity and Natural Ecosystems (greater risks of loss of vulnerable coastal and marine ecosystems including wetlands and coral reefs, increased risk of desertification and loss of biodiversity, impact on migratory species).

FIGURE 10 - Key Steps in the Environmental Impact Assessment (EIA) Process

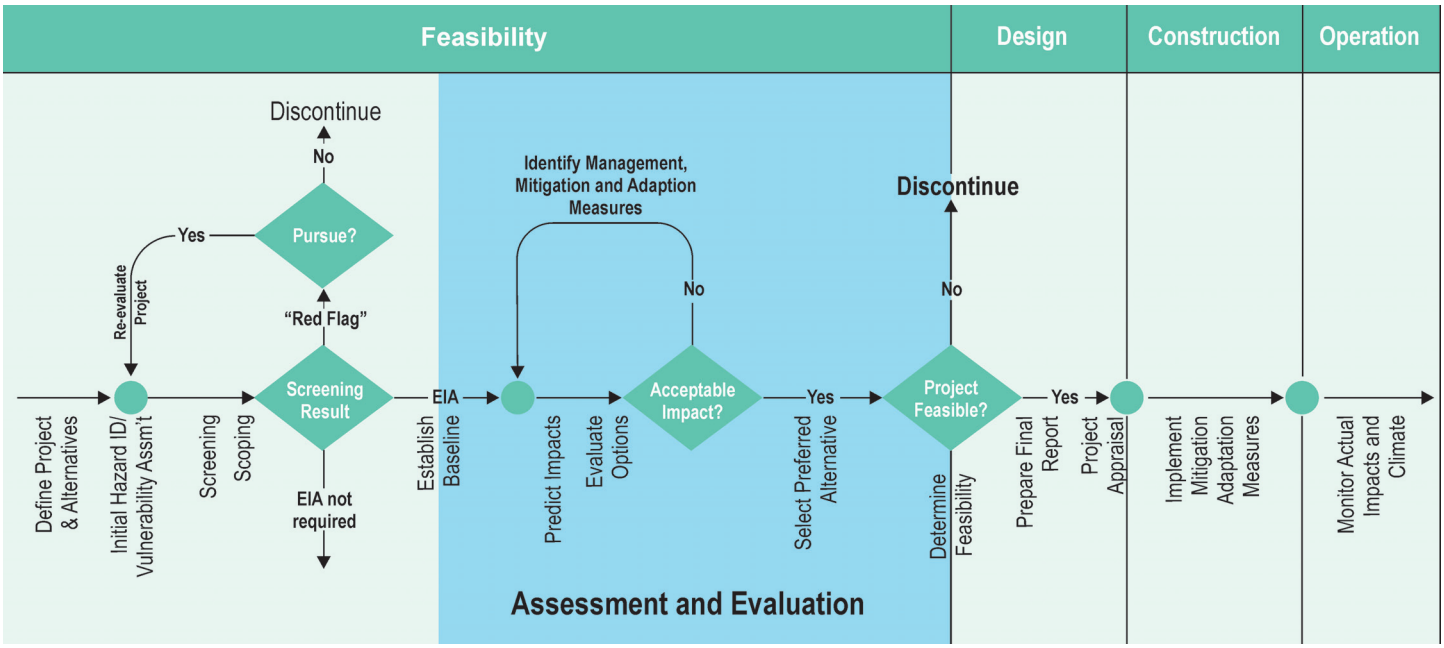
(Courtesy - EcoEngineering Consultants Limited (Trinidad and Tobago) 2003.)



The integration of climate change adaptation considerations should be undertaken within the existing environmental impact assessment framework, with little modification to existing processes and procedures. When considering the impacts of climate change, the

[1] IPCC projects that tropical cyclones (hurricanes) are unlikely to increase in frequency, but the most severe ones would increase in intensity in a warmer world. For heavy rain events, an increase in frequency is also projected.

FIGURE 11 - Modifications to the Environment Impact Assessment Process to Address Climate Change Adaptation Considerations



Adapted from EIA Flowchart provided by courtesy EcoEngineering Consultants Limited (Trinidad and Tobago) 2003.

EIA process evaluates a project's potential environmental risks and impacts in its area of influence; identifies and evaluates potential impacts from climate change on the project's area of influence; examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and anticipated adverse impacts from climate change, and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts and anticipated adverse impacts from climate change throughout project implementation. In addressing anticipated adverse impacts from climate change, the implementation of appropriate adaptation planning and management mechanisms is favoured. *Figure 11* highlights the modifications required to existing environmental impact assessment procedures to address climate change adaptation considerations.

The following steps should be undertaken to effectively ensure that climate change adaptation considerations are integrated into existing EIA processes.

2.2 Step 1: Define Project and Alternatives

Objective: Clearly describe the proposed project, identify alternatives to project and approaches to implementation.

Information needs:

- Project information: plan(s), design(s), costs, expected benefits
- Project scope: spatial and temporal boundaries
- Site information: location, environment, hazards, development and social setting

Process: Prepare project description and information on the site(s) identified, as per requirements of review agency, with natural hazard-related information added, as necessary.

Responsibility: Client/proponent

Climate change adaptation components of this step in the EIA

An application for an EIA should present detailed information concerning the nature, scope, setting (legal, financial, institutional) and timing for the proposed project or activity. The project/activity description should contain sufficient information to frame the EIA investigation so that time and resources are concentrated in areas where potential impacts are most significant. The description of the project/activity should identify environmental or social issues of concern, including any natural hazards that may affect project design, construction, implementation, or abandonment, and outline any alternatives that may be technically feasible. At the very least, all impact assessments should consider the 'no project' alternative (i.e., what the impacts would be if the project were not carried out). Any concerns or issues affecting local communities should be identified.

The initial project information form is intended to provide the EIA reviewing agency with sufficient information to understand the range and complexity of environmental issues raised by the project and the project site. Typically, the first use of the information provided on a project information form is to determine if an EIA is required. Consequently, the content of such forms is generally derived from the enabling authority or legislation for environmental assessment. While descriptions of the project and the project site are central components of all such forms, additional details may be required to review the potential natural hazard impacts or vulnerabilities.

At a minimum, the following information should be included in the initial project definition and description:

Project	Project site	Project scope
• Design criteria (e.g., building code used)	• Soils, Geology • Slopes and drainage • Location relative to coast, rivers • Hazard or damage history	• Timeframe for construction, use and abandonment

2.3 Step 2: Preliminary Vulnerability Assessment (Qualitative Analysis)

Objective: Preliminary identification of significant hazards and hazard impacts to inform EIA screening and scoping (steps 3 and 4).

Information needs:

- Prevalent hazards in project's zone of influence-frequency, distribution and magnitude. Climate scenarios. Factors influencing hazard occurrence. Disaster history.
- Characteristics of the project-the site, structures and processes Understanding of vulnerability to hazard impacts.

Process:

- Using existing information and expert knowledge, estimate frequency or probability of hazard events [initial hazard identification]
- Estimate severity of impacts on project components and zone of influence [initial assessment of vulnerability

Climate change adaptation component of this step in the EIA

Many projects for which EIAs are required have relatively long life spans, twenty to hundreds of years. This includes the construction of buildings, highways, port and harbour facilities and physical infrastructure of all kinds. Thus, it is important to consider how changing climate will influence the project and how the project will affect nearby resources, society and environment under future climatic conditions, not just those of the present.

But what future climate conditions should be examined and prepared for? These issues need to be addressed during the initial project screening process. During initial screening of the project, the project team should identify and evaluate potential

impacts from climate change on the project's area of influence. At this stage a *Qualitative Analysis* should be undertaken – that is one that is subjective and based on best professional judgement. The following questions should be considered during screening, and answered more fully during project evaluation/preparation:

1) What are the relevant climate change impacts that may affect the project?

Effective integration of climate change considerations requires that project-relevant short- medium- and long-term climate change impacts be identified using appropriate climate prediction models and climate change "scenarios." A scenario is a coherent, internally consistent, and plausible description of a possible future state of the world. Scenarios commonly are required in climate change impact, adaptation, and vulnerability assessments to provide alternative views of future conditions considered likely to influence a given system or activity (for more detailed explanation of climate change scenarios and modelling see *Annex 3*). A distinction is made between climate scenarios – which describe the forcing factor of focal interest to the Intergovernmental Panel on Climate Change (IPCC) – and non-climatic scenarios, which provide socio-economic and environmental "context" within which climate forcing operates. Most assessments of the impacts of future climate change are based on results from impact models that rely on qualitative climate and non-climatic scenarios as inputs (IPCC 2001).

Estimating project-relevant future climate and sea level is usually a two-step process. First, Global Climate Models (GCM's) which are based on well known equations of physics describing the climate system that have been tested against current and past climate conditions, and are used to project 20, 50 or 80 years into the future. The projections are based on assumptions about rates of increase in human-induced "greenhouse gases." Secondly, results for the location in question of several of these model projections for a suitable future time are statistically analyzed, and a range of future climate and sea level scenarios determined. Global model results can be "down-scaled" to a particular location by statistical means and in some cases through use of limited – area climate models "nested" within the GCMs.

There are two main causes of uncertainty in such analyses. The first lies in the assumptions about future greenhouse gas emissions and atmospheric concentrations, which depend upon rates of global population and economic growth, on future mixes of energy supplies, and on climate change policies – all difficult to predict. The second lies in the differences between the several models and the differing ways in which they simulate the complex natural processes of the atmosphere-ocean-vegetation system. The range of values is usually not excessive, however, since there is considerable convergence on these two main factors amongst the informed scientific community.

For the purpose of undertaking the initial screening it is recommended that climate change projections by the IPCC (see *Section 1.4*.) be used in conjunction with projections for the Caribbean and South Pacific regions (see *Section 1.5, Section 1.6* and *Annex 1*). In undertaking an EIA, it is unlikely that project-relevant scenarios can be generated in all instances in view of the status of climate modelling at the national and regional levels. Accordingly, a "risk-management" approach should be utilised to develop appropriate climate change scenarios that are relevant for the life-span of the proposed project. Risk Management Guidelines[2] such as those developed for climate change in the Caribbean provide a systematic procedure for taking into account the uncertainties involved (see *Annex 4*).

In addition, the use of the *range of outcomes*, rather than a single projection, can give the EIA analyst the opportunity of judging the probable ranges of impacts on the project – and of the project on future resources, society and environment in the affected area. *In order to reduce costs associated with developing multiple "project relevant" climate change scenarios it is suggested*

[2] These Guidelines were developed under the CIDA sponsored ACCC project and based in part on those of the Canadian Standards Association.

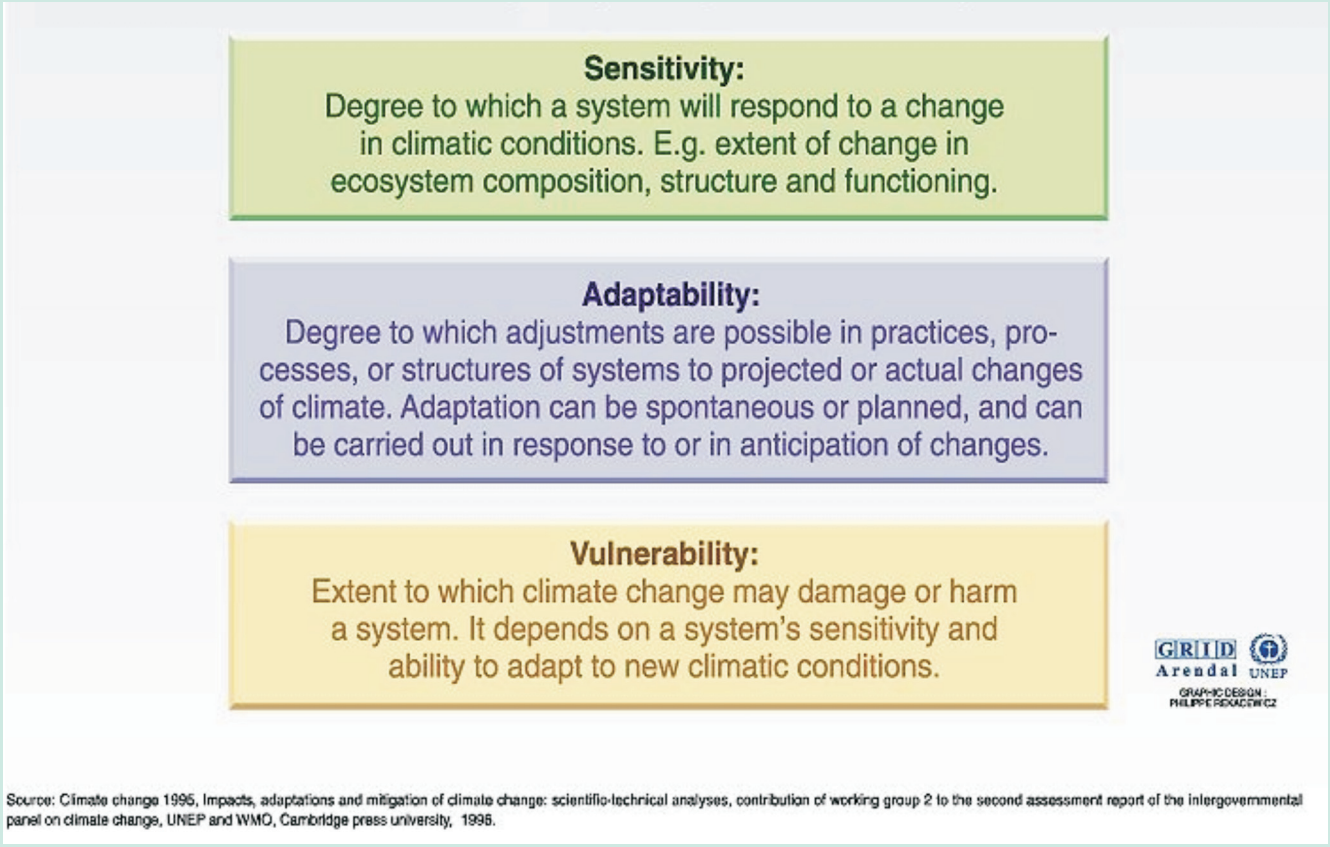
that the initial evaluation identify project and ecosystem components that constitute high risk/impact from climate change which would warrant further quantification through the development of project relevant climate change scenarios for identified high risks. Low to medium risks/impacts would not require further quantification.

It is suggested that the process for *"Estimating Frequency or Probability of an Event"* and *"Estimating Severity of the Impacts"* as articulated in the *Caribbean Risk Management Techniques for Climate Change* (2003) be used to identify project and ecosystem components at high risk/impact from climate change that would warrant further quantification through the development of project relevant climate change scenarios for identified high risks (see *Figures 13 and 14*).

In undertaking the preliminary evaluation for the project, the

FIGURE 12 - Sensitivity, Adaptability and Vulnerability

The potential impacts of climate change on the environment and socio-economic systems can be understood in terms of sensitivity, adaptability and vulnerability of the system. Both the magnitude and the rate of climate change are important in determining the sensitivity, adaptability and vulnerability of a system. Although much progress has been made, there are large uncertainties in predicting regional climate changes, future conditions in the absence of climate change, or to what degree climate will become more variable. All these factors are important in predicting the potential impacts of climate change. There are large uncertainties in our understanding of some key ecological processes. Current ability is also limited in predicting regional-scale climate changes, future conditions in the absence of climate change, or to what degree climate will become more variable. All these factors are important in predicting the potential impacts of climate change.



Source: Climate change 1995, Impacts, adaptations and mitigation of climate change: scientific-technical analyses, contribution of working group 2 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge press university, 1996.

project team needs to be cognisant of the fact that vulnerability varies substantially by sector and region within countries and also by socio-economic groups. The use of the risk management process will assist in the identification of high risk/impact projects that required detailed study and the development of project-relevant "downscaled" climate scenarios. For example, such a process will determine the relevant vulnerability of major capital expenditure on physical infrastructure such as sea defence structure which because of its long physical life and its ability to influence future land use pattern may present a higher vulnerability (risk/impact) than the construction of a secondary school in a flood plain or a 50-100 room hotel in a coastal location.

To evaluate and review the impacts of climate change on any project as part of the screening process, the independent EIA expert or advisory panel should be skilled in climate change modelling and the development of project-relevant climate models using a risk management approach.

FIGURE 13 - Estimating Frequency or Probability of an Event

Extract from *Caribbean Risk Management Techniques for Climate Change* (ACCC 2003).

The purpose of this particular exercise is to determine the relative frequency with which the various risk scenarios can be expected to occur over a given period of time. [Typically this can be based on historical data that can be had from a number of sources. These can include regional and/or country specific scientific studies and research papers, records of extra-regional countries and areas, and insurance company records, to name a few.] Such data should indicate how often particular risk scenarios have occurred in the past. This is used to form a judgement as to the likelihood of their occurrence in the future, assuming a stable unchanging world. Using climate scenarios developed by the CCCCC, a similar process should be undertaken to determine probable risk scenarios arising from future climate in a changing world. If there is no easy or ready access to credible data there are other statistical techniques that can be used as part of the iterative process.

The "Frequency or Probability Rating" shown below and the "Risk Assessment Matrix" discussed in Step 4 can be used to define the magnitude of potential risks.

TABLE 1: Frequency/Probability Rating

Hazard	Very Unlikely to Happen	Occasional Occurrence	Moderately Frequent	Occurs Often	Virtually Certain to Occur
Hazards from risk scenario (deal with each separately)	Not likely to occur during the planning period	May occur sometime but not often during the planning period	Likely to occur at least once during the planning period	Likely to occur several times during the planning period	Happens often and will happen again during the planning period

FIGURE 14 - Estimating Severity of the Impacts

Extract from *Caribbean Risk Management Techniques for Climate Change* (ACCC 2003).

Estimating severity usually focuses on determining the potential health, property damage, environmental or financial impacts of risk scenarios. In the case of commercial enterprises, financial impacts are most important when dealing with a profit-maximizing concern. However, in the context of climate change adaptation, the work team can choose to include non-financial criteria such as the loss of life, effect on GDP, environmental impacts or any other relevant measure that is suited to best expressing the potential impacts in measurable terms. The risk management team develops an impact severity rating scale appropriate to the risk scenarios such as the table shown below.

TABLE 1: Direct Impact Rating Matrix

Impact / Severity	Social Factors			Economic Factors				Environmental Factors			
	Displace-ment	Health	Loss of Livelihood	Cultural Aspects	Property Loss	Financial Loss	GDP Impact	Air	Water	Land	Eco-systems
Very low											
Low											
Moderate											
Major											
Extreme											

2) What, if any, project elements are likely to be affected significantly by climate change?

This question should be addressed initially as part of the screening process using the process for *"Estimating Frequency or Probability of an Event"* and *"Estimating Severity of the Impacts"* as articulated in the *Caribbean Risk Management Techniques for Climate Change* (2003). This evaluation will identify project and ecosystem components that are at high risk/impact from climate change, whereby projects are assigned and appropriate "risk" category A, B, or C. This determination involves the identification of key project elements and projected impacts from climate change in and around the project area of influence. A summary of anticipated impacts resulting from climate change and climate variability in the Caribbean is provided in *Annex 5*. An example of the evaluation that should be undertaken during this stage in the EIA process is provided in *Figure 14*.

FIGURE 15 - Example of the evaluation that should be undertaken during this stage in the EIA process

- Is any water resource management program – including infrastructure – to be significantly impacted by changes in rainfall patterns, increased evaporation, and reductions in ecosystem resilience brought about by climate change?
- Is any agricultural reform program likely to be significantly impacted by changes in rainfall patterns, reductions in ecosystem resilience brought about by climate change, or changes in incidents in agricultural pests and diseases resulting from climate change?
- Is any pollution prevention program or biodiversity conservation program likely to be significantly impacted by reductions in ecosystem resilience brought about by climate change?
- Is any coastal infrastructure to be significantly impacted by sea-level rise, increased storm events, or flooding?
- What are the social, human health, ecological and economic impacts associated with damage to any coastal infrastructure resulting from sea-level rise, increased storm events, or flooding?

IN ORDER TO EVALUATE POTENTIAL FLOOD HAZARD RESULTING FROM CLIMATE CHANGE, THE ENVIRONMENTAL ASSESSMENT TEAM NEEDS TO DETERMINE:

- What are the likely climate change scenarios for flooding?
- How often the floodplain will be covered by water?
- How long the floodplain will be covered by water?
- At what time of year flooding can be expected?
- Where are the floodplain and flood-prone areas?

2.4 Step 3: Initial Screening

Objective: Determine, based on information provided, whether: a) the project is likely to have a significant effect on the environment and b) climate change impacts are likely to have significant effects on the project, and therefore require further study.

Information needs: Initial project description and output of preliminary vulnerability assessment.

Process: Using information from preliminary vulnerability assessment, assign appropriate category based on frequency, probability and severity of impacts.

Responsibility: Reviewing agency.

Climate change adaptation components of this step in the EIA

It is essential that potentially significant impacts from climate change that may affect project siting and/or design be identified at the beginning of an assessment through the preliminary evaluation process, and be taken into account in determining the appropriate type and scope of analysis. This may be achieved through environmental *screening* into one of three categories according to the nature and extent of potential climate change impacts:

Category A for significant impacts;

Category B for limited impacts;

Category C for minimal or no impacts.

At the earliest stage of the project cycle, the EIA Administrator, with the project proponent's concurrence, assigns the proposed project to one of three categories (A, B, or C), reflecting the potential environmental and climate change risks associated with the project.

Category A: A proposed project is classified as Category A if it is *highly likely* to have (i) significant adverse environmental impacts that are sensitive, diverse, or unprecedented; or (ii) the anticipated short-to mid-term impacts from climate change are *highly likely* to result in significant adverse social, economic, structural or environmental impacts. These impacts may affect an area broader than the sites or facilities subject to physical works. An EIA for a

Category A project: (i) examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance; and (ii) identifies short-, medium- and long-term climate change impacts from appropriate models or climate change scenarios, evaluates social, economic, structural or environmental impacts arising from climate change, identifies and evaluates appropriate adaptation planning and management mechanisms, and recommends any measures needed to adapt to (prevent, minimize, mitigate) or compensate for adverse climate change impacts.

Category B: A proposed project is classified as Category B if: (i) its potential adverse environmental impacts on human populations or environmentally important areas-including wetlands, forests, grasslands, and other natural habitats – are less adverse than those of Category A projects, or (ii) the anticipated short- to mid-term impacts from climate change are likely to result in social, economic, structural or environmental impacts that are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigatory and climate change adaptation measures can be designed more readily than for Category A projects. The scope of EIA for a Category B project may vary from project to project, but it is narrower than that of Category A EIA (e.g., a "focus report"). Like a Category A EIA it: (i) examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance, and (ii) identifies short-, medium- and long-term climate change impacts from appropriate models or climate change scenarios, evaluates social, economic, structural or environmental impacts arising from climate change, identifies and evaluates appropriate adaptation planning and management mechanisms, and recommends any measures needed to adapt to (prevent, minimize, mitigate) or compensate for adverse climate change impacts.

Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts, or minimal anticipated short-, medium- or long-term impacts from climate change. In such circumstances a detailed EIA report is seldom required.

The EIA Administrator and/or the project proponent records in the Project Document that summarises the project description: a) the key environmental issues (including any resettlement, indigenous peoples, and cultural property concerns); b) anticipated project-relevant climate change scenarios in the short- medium-, and long- term; c) the project category and the type of EIA needed; d) and proposed consultation with project-affected groups and local non-governmental organizations (NGOs), including a preliminary schedule of consultations.

2.5 Step 4: Scoping (Category A and Category B Study)

Objectives: Identify and agree upon the critical issues to be addressed in the EIA and the information and analyses required for inclusion in the environmental assessment report to determine acceptability and feasibility of the project.

Information needs:

- Baseline data on project site, existing detailed hazard maps and assessments
- Significant hazards and potential impacts on project and zone of influence/ project boundaries identified in screening
- Information on relevant legislation and institutions
- Climate change assessments

Process: Identify information needs regarding significant hazards and vulnerabilities. Specify analyses that must be conducted to complete project assessment. Agree on the terms of reference/scope of work for the impact assessment.

Responsibility: Reviewing agency.

Climate change adaptation components of this step in the EIA

In instances where climate change impacts are likely to result in significant impacts, the EIA team identifies and prioritizes significant impacts for assessment. This initial stage in the EIA process (termed. "scoping") should include agreement on the following aspects:

Project Description and Definition of Spatial Boundaries - the definition of the project and its area of influence;

Definition of Other Project Boundaries - the identification of temporal boundaries affecting project activities (including time frame for climate change impacts that are to be evaluated), and the identification of regulatory, administrative and customary aspects affecting the project or project activities

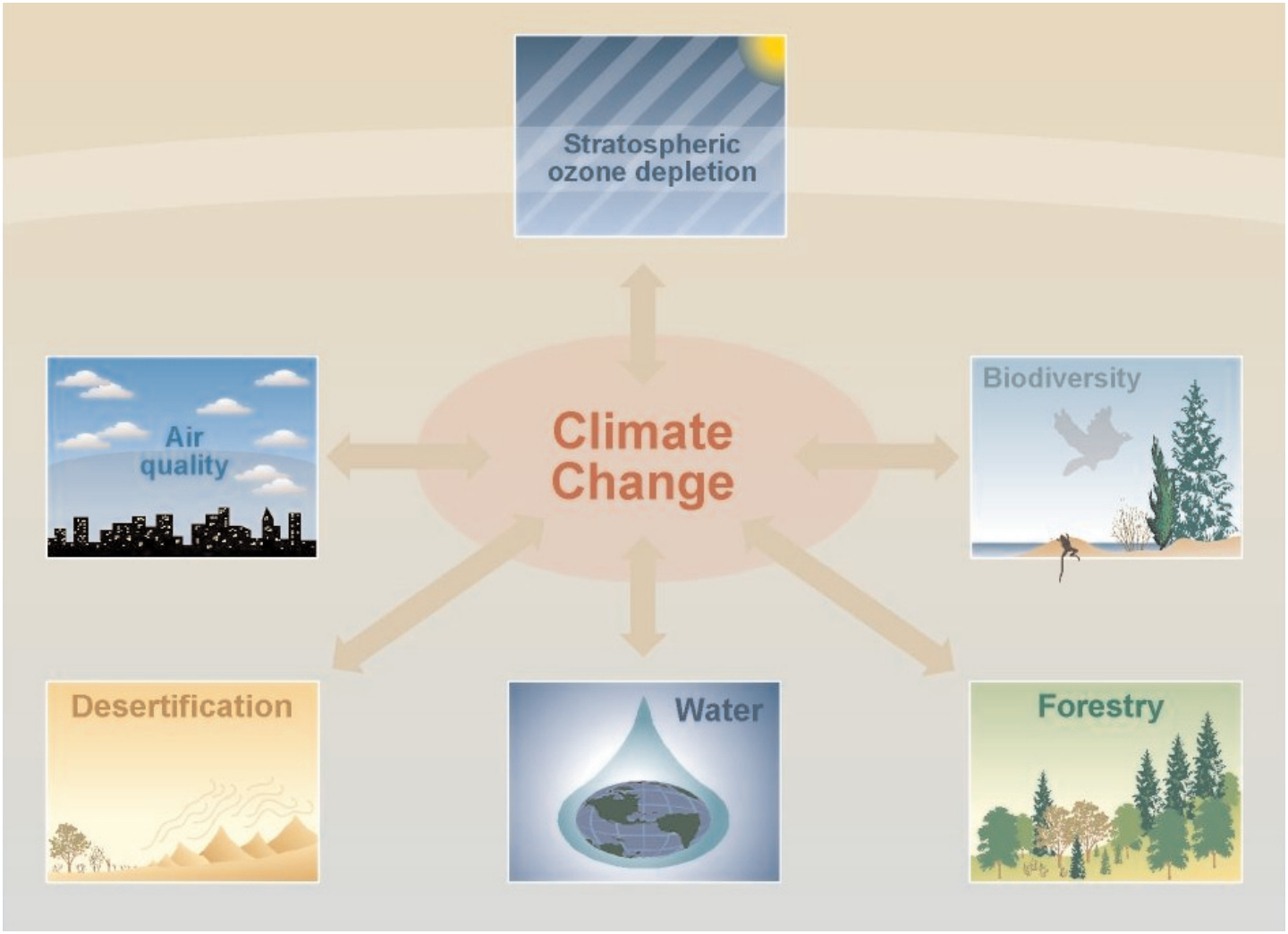
Baseline Environmental Setting - data to be collected and monitored for the identification of ecological, climatic, cultural and social features relevant to the spatial and temporal boundaries of project activities;

Project-Relevant Climate Models - the identification of appropriate climate predictions relevant to the spatial and temporal boundaries of project activities;

Project-Relevant Climate Change Scenarios (Impacts) - project relevant "downscaled" climate change scenarios (for high risk/impact valued ecosystem components) relevant to the proposed project or development - as identified in *Step 2*. As applicable to the project, the identification of climate change impacts should be assessed in regard to:

a) Biodiversity and Wildlife
b) Ecosystems and their Goods and Services (Agriculture,

FIGURE 16 - Linkages Between Climate Change and Other Environmental Issues



Source: IPCC International Panel on Climate Change

Forestry, Fisheries, Aquaculture, Coastal Zones and Marine Ecosystems)

c) Hydrology and Water Resources

d) Soils and Land Resources

e) Human Settlements (including buildings and structures), Energy and Industry

f) Insurance and Other Financial Services

g) Human Health

h) Socio/economic Development.

A key factor affecting public acceptability of and support for any proposed development is the level and nature of public consultation that has been undertaken and the amount of public input obtained in the project design. Scoping normally requires public consultation to determine the utility value attached to affected ecosystem features. The EIA process should ensure transparency in all decision-making, provide timely, adequate and accurate information to the public, and provide access to the public to all relevant documents that are not confidential. There will be instances (especially with private sector development) where information may not be fully disclosed and is protected by law to ensure confidentiality in order to protect a legitimate economic interest, protect location of valuable cultural property, intellectual property rights, issues affecting international relations and national defense. Where vulnerable groups are affected in these instances, specially designed mechanisms will be required to regulate and control access to certain information that may be regarded as "confidential" or "sensitive". *However, to assist in any public consultation process it is essential that project-relevant climate change scenarios be agreed upon and made available to the public together with other EIA documentation.*

2.6 Step 5 - Assessment and Evaluation (Category A and Category B Study)

Upon the completion of scoping, an assessment and evaluation (EIA study) should then be undertaken of:

- the impacts of the project and project activities on the existing environment (i.e. in the absence of climate change considerations);
- the impacts of the project and project activities on social and economic development;
- the impacts of the project and project activities on community values.

This evaluation constitutes the usual assessment process undertaken for an EIA, and serves to establish the assessment "baseline" against which climate change considerations will be evaluated. Once the baseline assessment has been undertaken, an assessment and evaluation should be undertaken of the impacts of climate change on the project and project activities, which should include an assessment and evaluation of identified climate change impacts (see *Step 2*) relevant to:

a) Biodiversity and Wildlife

b) Ecosystems and their Goods and Services (Agriculture, Forestry, Fisheries,

Objective: Fully assess and characterise significant natural hazards, their potential impact on the project and potential effects on those hazards introduced by the project.

Information needs:

Baseline data

Hazard studies and maps indicating past incidence (caution re: climate change historical data)

Factors influencing hazard occurrence

Climate change scenarios

Process:

1. Establish baseline
2. Predict impacts
3. Evaluate management, mitigation and adaptation options
4. Select preferred alternative
5. Determine feasibility

Responsibility: Client/Proponent to undertake assessment, including detailed vulnerability assessment (Quantitative Analysis), using specialists (natural hazards, engineering, social), as appropriate.

Climate change adaptation components of this step in the EIA

Aquaculture, Coastal Zones and Marine Ecosystems)

c) Hydrology and Water Resources
d) Soils and Land Resources
e) Human Settlements (including buildings and structures), Energy and Industry
f) Insurance and Other Financial Services
g) Human Health
h) Socio/economic Development.

A summary of anticipated impacts on the above sectors resulting from climate change and climate variability in the Caribbean Region is provided in *Annex 5*.

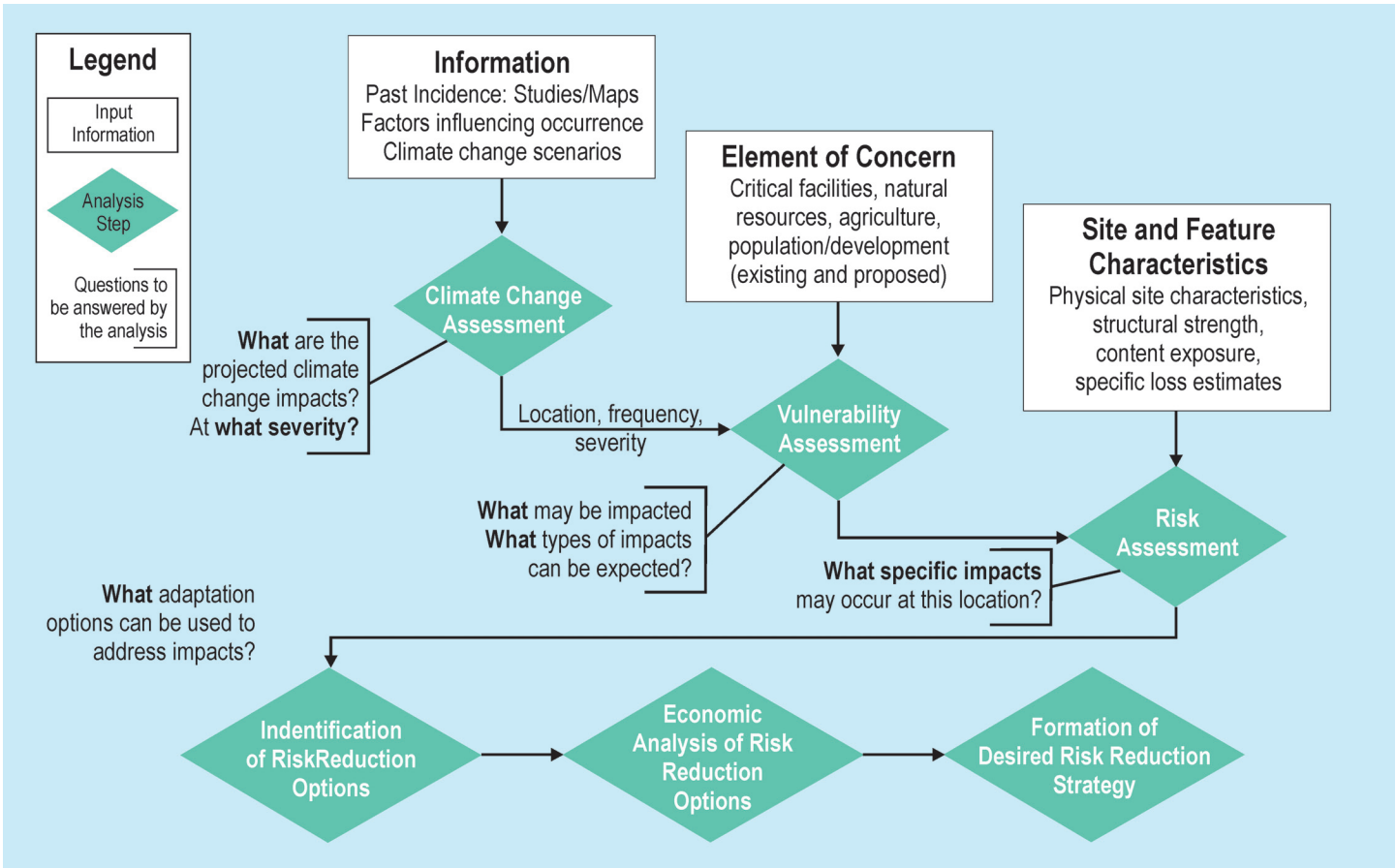
At this stage in the process a detailed *Quantitative Analysis* (see *Figure 17*) should be undertaken that uses environmental variables represented by numbers or ranges, often accomplished by numerical modelling or statistical analysis. A "model" of the Terms of Reference for undertaking a detailed vulnerability assessment of climate change is provided in *Annex 6*. A sample Terms of Reference for undertaking a Category A assessment is provided in *Annex 7* and an example of climate change impacts that affect the above sectors in St. Lucia is included in *Figure 19*.

The detailed vulnerability assessment may require the development of project relevant climate change scenarios (i.e., "downscaled" scenarios) and should also address "cumulative impacts" (see *Section 3*) and result in:

- the identification of impacts that need to be addressed;
- a quantification of their significance; and
- a determination as to whether appropriate management, mitigation or adaptation measures be established through an environmental management plan (including the climate change adaptation program - see *Step 6* below). The management, mitigation and adaptation options should emphasis re-design and relocation as viable options.

The assessment should also be undertaken on a scenario where there is no project (i.e., status

FIGURE 17 - Detailed Climate Change Impacts Evaluation



quo), in other words, how would the natural environment behave in the absence of human-made intervention?

Costs associated with appropriate management, mitigation and adaptation measures has implications for project viability. Accordingly, the *assessment should include an evaluation of the economic implications of such measures to provide a meaningful indicator to decision-makers. This economic evaluation should include a costs/benefits analysis of alternative management, mitigation and adaptation options* (see *Step 7*).

2.7 Step 6: Environmental Management Plan (Climate Change Adaptation Plan)

Environmental management plans that are developed as part of the EIA process are not designed to normally address the impacts of climate change. Accordingly, a *Climate Change Adaptation Program* (see *Figure 21*) should be developed as part of the EIA process to address significant impacts from climate change that will affect the project (including project activities and project area of influence) and define adaptation measures that will be established to address climate change impacts on the following (as relevant to the project and project activities):

a) Biodiversity and Wildlife

b) Ecosystems and their Goods and Services (Agriculture, Forestry, Fisheries, Aquaculture, Coastal Zones and Marine Ecosystems)

c) Hydrology and Water Resources

d) Soils and Land Resources

e) Human Settlements (including buildings and structures), Energy and Industry

f) Insurance and Other Financial Services

g) Human Health

h) Socio/economic Development.

Examples of climate change adaptation measures for biodiversity and wildlife, human settlement, water resources, agriculture and food security are provided in *Figure 21* and *22*.

Adaptation planning and management regimes have been broken down into four principal types of strategy for adapting to the effects of climate change, namely:

Strategy A - Prevention of Loss, Tolerating Loss (Enhancing the Resilience of Natural Systems), and Spreading/Sharing Loss

- *Prevention of loss* involves anticipatory actions to reduce the susceptibility of an exposure unit to the impacts of climate.
- *Tolerating loss* (includes enhancing the resilience of natural systems) involves situations where adverse impacts are accepted in the short term because they can be absorbed by the exposure unit without long-term damage.
- *Spreading or sharing* loss involves action which distribute the burden of impact over a larger region or population beyond those directly affected by the climatic event.

Strategy B - Changing Use or Activity

- *Changing use or activity* involves a switch of activity or resource use to adjust to the adverse as well as the positive consequences of climate change.

Strategy C - Relocation

- *Relocation* involves situations where the preservation of an activity is considered more important than its location, and migration occurs to areas that are more suitable under the changed climate.

Strategy D - Restoration

- *Restoration* aims to restore a system to its original condition following damage or modification due to climate.

The climate change adaptation program should cover: planned adaptation; management mechanisms (principally policies, laws, institutional structures); and autonomous adaptation strategies. Any Climate Change Adaptation Program that is developed as part of an EIA should be consistent with the *National Adaptation Policy* formulated pursuant to the requirements of the *United Nations Framework Convention on Climate Change* (UNFCCC) (see *Figure 21*). The Climate Change Adaptation Program should draw upon findings from analysis of policy, legal, and institutional issues as well as the analysis of climate change impacts and the determination of appropriate alternatives for adaptation planning and management. *The Climate Change Adaptation Program should be developed in consultation and collaboration with National Climate Change Focal Point (established under the United Nations Framework Convention on Climate Change) and affected communities.*

FIGURE 18 - Types of Adaption to Climate Change

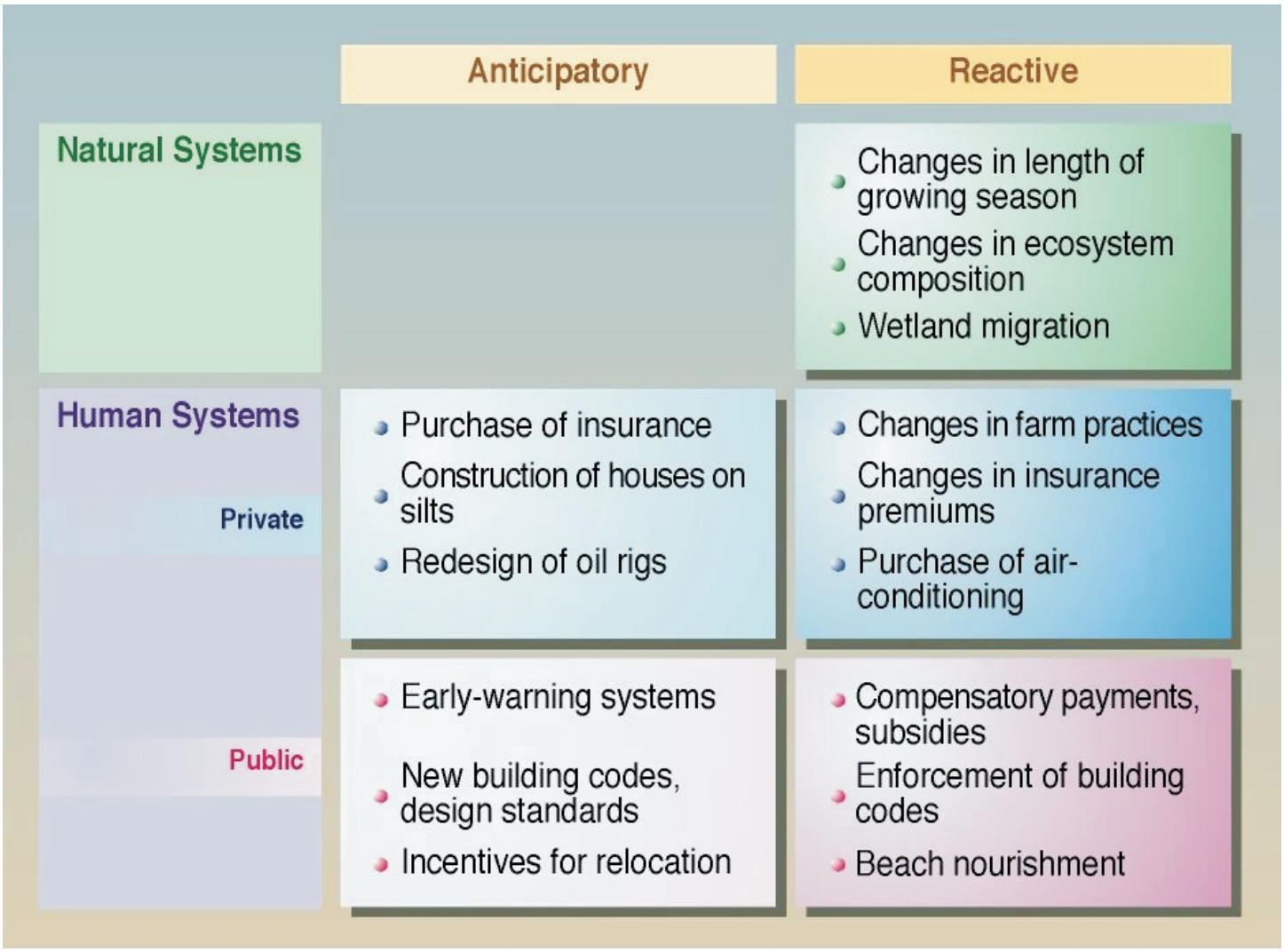


FIGURE 19 - Impacts on Sectors in St. Lucia

Taken from *St. Lucia National Adaptation Policy and Action Plan* (2002) - developed under the World Bank/GEF Funded Caribbean Planning for Adaptation to Climate Change (CPACC) project.

a) Biodiversity and Wildlife

- Changes in the composition of natural biodiversity (marine and terrestrial) due to changing climatic, hydrological and edaphic conditions;
- Increased vulnerability of threatened ecosystems due the same conditions;
- Alterations in plant-plant, animal-animal and plant-animal associations.

b) Ecosystems and their Goods and Services - Agriculture

- Increased water demand and reduced water supply due to increased temperatures;
- Increased occurrence of agricultural pests;
- Reduced production due to modified agro-climatic regimes;
- Accelerated soil erosion and increased salinisation.

c) Coastal Zones and Marine Ecosystems

- Inundation of coral reefs, seagrass beds and mangrove swamps as a result of sea level rise;
- Erosion of beaches and coastal lands due to sea level rise and changing coastal processes;
- Loss of fishery production due to increased sea temperatures and sea level rise;
- Fish kills and coral die-off due to increased sea water temperatures.

d) Hydrology and Water Resources

- Changes in temporal and spatial distribution due to increased climate variability and occurrence of severe events such as cyclones and droughts;
- Contamination of ground water due to salt-water intrusion arising from sea level rise;
- Sedimentation of dams and reservoirs due to increased soil erosion arising from the greater frequency of extreme rainfall events;
- Water shortages due to increased drought.

e) Soils and Land Resources

- Changes in the composition of natural vegetation due to changing climatic, hydrological and edaphic conditions;
- Increased soil fragility and hence, erosion.;
- Alterations in plant-plant, animal-animal and plant-animal associations.

f) Human Settlements, Energy and Industry

- Damage to coastal property and infrastructure due to storm surges;
- Damage to houses, businesses and other properties due to increased intensity and frequency of cyclonic events.

g) Insurance and Other Financial Services

- The effects of catastrophic events such as severe hurricane damage on lending institutions, insurers, re-insurers and property owners;
- The diversion of financial resources from productive investment to restorative and activities.

h) Human Health

- The increased incidence of mosquito borne and other vector borne diseases (such as dengue fever) as higher temperatures favour the proliferation of mosquitoes and other disease carriers;
- A higher occurrence of heat and stress related illnesses and conditions;
- An increase in water related diseases especially water borne diseases, particularly following extreme rainfall events.

i) Socio/economic Development

- Damage to and destruction of hotels and other tourism infrastructure located in coastal areas susceptible to storm surges, erosion and sea-level rise;
- Loss of economic returns due to the possible changes in or loss of coral reefs, beaches, natural forests and other natural resources and attractions;
- Reduced visitor arrivals as result of a higher frequency of extreme weather events such as hurricanes, as well as reduced inducement for travel as a result of higher temperatures in traditional tourism centres;
- Negative changes in water and food arising from changes in precipitation levels and distribution, loss of forest cover and related factors.

FIGURE 20 - Adaptation Planning and Management

Article 4 of the *United Nations Framework Convention on Climate Change* outlines commitments to be undertaken by parties signing the Convention, which include the following:

"*a) Formulate, implement, publish and regularly update national, and where appropriate, regional programmes containing...**measures to facilitate adequate adaptation to climate change**;"*

*"e) **Cooperate in preparing for adaptation to the impacts of climate change**; develop and elaborate appropriate and integrated plans for coastal zone management, water resources and agriculture, and for the protection and rehabilitation of areas ...affected by droughts and desertification, as well as floods;"*

*"f) Take climate change considerations into account, to the extent feasible, in their relevant social, economic and environmental policies and actions, and employ appropriate methods, **for example impact assessments, formulated and determined nationally, with a view to minimizing adverse effects on the economy, on public health and on the quality of the environment, of projects or measures undertaken by them to mitigate or adapt to climate change."***

According to the Intergovernmental Panel on Climate Change (IPCC) the concept termed "adaptation" -

"*Is concerned with responses to both the adverse and positive effects of climate change. It refers to any adjustment – whether positive, reactive, or anticipatory – that can respond to anticipated or actual consequences associated with climate change. It thus implicitly recognizes that future climate change will occur and must be accommodated in policy*" (IPCC, 1996, p. 831).

There are various ways to classify and distinguish between adaptation strategies. First, depending on the timing, goal, and motive of its implementation, adaptation can be either *reactive* or *anticipatory*. Reactive adaptation occurs after the initial impacts of climate change have become manifested, while anticipatory adaptation takes place before impacts are apparent. Second, adaptation may be considered to be *autonomous* or *planned*. Autonomous adaptation occurs without intervention of an informed decision-maker, while planned adaptation requires informed and strategic actions. Most natural and socio-economic systems will undergo autonomous adjustments in response to changing climatic conditions. These adjustments are likely to occur both to gradual changes in climate and to more drastic events. Planned adaptation is the result of a strategic policy decision based on the awareness that conditions have changed or are about to change, and that action is needed to return to or maintain a desired state. This planned adaptation can be both reactive and anticipatory, while autonomous adaptation is always reactive.

Human and ecological systems adapt to negative effects of climate change through a combination of technological and behavioural adjustments. Adaptation refers to those adjustments in individual, group and institutional behaviour in order to reduce society's vulnerabilities to climate, and thus reduce its impacts, and may include activities or actions undertaken in order to accommodate, cope with or reduce the adverse effects of climate change. In some cases, adaptation can also include those activities undertaken in order to benefit from the effects of climate change. Adaptation to climate change includes those activities that take place over and above normal environmental (i.e., autonomous) adaptation. It should also be recognized that a series of positive incremental changes can result in cumulative reductions in the vulnerability of a coastal area to the impacts of climate change.

The suitability of a particular adaptation strategy is highly sensitive to local conditions, priorities and choices. Planned adaptation involves preparing institutional structures (policies, laws, organizational capacity), developing expertise, implementing appropriate management mechanisms, and building knowledge. These are relative slow processes which require adequate institutional capacity, but to be effective there should be no delay in their initiation. Such anticipatory approaches will greatly reduce the potential cost of forced *ad hoc* adaptation responses at a later date when loss of resources and poorly planned development will limit the range of adaptation options available. The long lead time associated with climate change response requires planned adaptive strategies to explicitly confront the large uncertainties relating to the nature, scope and intensity of climate change impacts.

Adaptation measures should be viewed as actions that will result in benefits independent of climate change. What does adaptation look like in practice? The view has been expressed (R. Pielke, 1998) that three guiding principles exist:

a) Adaptation proceeds in a procedurally rational fashion – that is adaptation is not a "response" but instead a portfolio of responses;

b) Adaptation is a shared responsibility; and

c) Adaptation links the documented needs of today with the expected problems of tomorrow. Effective adaptation planning and management requires that policy makers benefit from a more systematic understanding of the impact of climate (and climate change) on the human and natural environment, are provided with tools to evaluate the costs and benefits of adaptation, and establish effective policy instruments and management mechanisms to reduce vulnerabilities to climate change.

FIGURE 21 - Climate Change Adaptation Program to Address Impacts on Select Sectors in St. Lucia

Taken from St. Lucia National Adaptation Policy and Action Plan (2002) - developed under the World Bank/GEF Funded Caribbean Planning for Adaptation to Climate Change (CPACC) project.

a) Biodiversity and Wildlife

- Expand and strengthen coastal monitoring and data collection activities in order to improve decision making on biodiversity protection and conservation;
- Undertake a national assessment of national biodiversity and resources at risk from climate change;
- Adopt short medium and long-term measures to protect coastal lands and to increase the resilience of coastal ecosystems and resources; such measures may include construction of coastal defence structures, enforcement of setbacks and restoration of coastal wetlands;
- Promote the restoration of damaged or destroyed coastal resources and coastal ecosystems where possible and technically feasible;
- Develop a comprehensive national land use and management plan, which *inter alia*, incorporates climate change concerns and which, based upon such concerns, makes prescriptions regarding the location of coastal developments;
- Identify and promote alternative fishery and resource use activities (e.g., mariculture) where impacts on ecosystems and natural resources preclude the continuation of traditional activities;
- Foster increased awareness and knowledge on the part of the general public regarding climate change impacts on the coastal and marine environment.

b) Human Settlement

- Undertake a comprehensive assessment of human settlements and related infrastructure at risk from the effects of climate change, the results thereof will be incorporated into national land use and disaster management plans;
- Develop a comprehensive national land use and management plan, which *inter alia*, incorporates climate change concerns and which, based upon such concerns, makes prescriptions regarding the location of future settlements and urban development without compromising water supply and other such requisites for the sustainability of settlements;
- Develop and implement a plan for the relocation or protection of settlements and infrastructure at risk from the effects of climate change;
- Ensure the incorporation of climate change considerations into existing or proposed national emergency plans;
- Promote the development and enforcement of a building code which addresses climate change considerations including hurricane resistance; energy/heat efficiency and flood resistance;
- Ensure that national infrastructure standards (jetties, roads, bridges, etc.) are adequate to withstand the effects of climate change;
- Integrate climate change considerations into the physical planning process including the implementation of Environmental Impact Assessment requirements;
- Implement fiscal measures where appropriate to encourage the adoption of building codes and other relevant measures;
- Foster increased public awareness of climate change and its effects on human settlements;
- Encourage the financial sector to develop mechanisms aimed at assisting human settlements affected by climate change.

FIGURE 22 - Potential Adaptation Measures to Address Climate Change Impacts on Water Resources, Agriculture and Food Security

WATER RESOURCES

A range of potential adaptation measures have been identified for reducing water demand, increasing available supply, reducing flood damages, improved monitoring and research. These are itemized in the following lists 5.1 to 5.5 drawn from work under ACCC Component 6 on Adaptation in the Water Sector.

Adaptation Options

Adaptation options that might be considered and costed fall into four main categories: demand management, supply management, flood damage reduction, monitoring and studies

5.1 Demand Management

- Re-assess water demand in light of population and climate changes.
- Develop more effective resource availability plans based on permitting systems.
- Where possible introduce water metering and charges by usage, taking into account in some way the absolute needs of poorer members of the community.
- Introduce water and sewage recycling measures.
- Offer rewards for demonstrated water conservation measures and for not exceeding permits.
- Undertake public information campaigns on water conservation.
- Improve efficiency of irrigation systems.

5.2 Supply Management

- Adopt watershed management plan for key water supply basins taking into account climate change – with vegetation, agriculture, permitting, etc., to be directed towards protecting water quantity and quality.
- Protect water recharge areas for important aquifers to preserve quality and quantity.
- Consider expansion and improved treatment of water supply systems for communities as required.
- Increase, when practical, storage capacities of water supply structures for resilience to greater variations and extremes.
- Implement programs of rainfall capture (on roofs for example) for water supplies.
- As a last resort consider desalination options – preferably solar powered.

5.3 Flood Damage Reduction

- In critical areas, develop flood plain maps, including climate change projections, and zoning or fiscal measures to limit development in flood plains.
- Encourage and develop detention and filtration ponds.
- Limit, where possible, the extent of impervious (paved) areas.
- Reconsider design criteria for drainage and flood control facilities to take into account climate change to date and projections, and begin implementation of necessary modifications.
- Review warning and preparedness systems to ensure their effectiveness in a changing climate.

5.4 Monitoring and Studies

- Review monitoring systems for water levels, flows, water quality rainfall and temperatures to ensure that trends can be detected, and that sudden episodes (pollution, flood) are documented.
- Determine more accurately water use (evapotranspiration) of various crops for consideration in watershed planning, considering climate change implications for those uses.
- Undertake analyses of trends and extremes from historical and current data and make them widely available. Review and document the changes in weather events (precipitation, floods, storms, hurricane river flow and other hydrological data) with a view to identifying the most vulnerable components of the water sector and providing unbiased information that can be easily used by all decision makers in the water sector.
- Seek to improve short-term weather and seasonal climate forecasting and their use to improve short-term adaptive capacity

Finally, it must be emphasized that the adaptation options above must be considered as just a check-list from which the most promising can be analyzed in more detail. In addition, experienced water mangers in the Caribbean will undoubtedly have additional options they might wish to consider.

5.5 Some General Guidelines

In considering the above potential adaptation options and their likely value and costs, the following general considerations should be kept in mind.

- Options are likely to be more acceptable in those cases where they are wise measures at present, without significant climate change ("no regrets") and where there are co-benefits.
- Incentives rather than penalties are usually more acceptable in changing behaviour.
- Low risk/low tech options are usually more effective than complex technologies.
- Use of total cost-accounting approach when evaluating options is recommended but adopt timelines that span generations.
- It is wise to pursue proactive planning to be ready when public and political interests are prepared to act (e.g., right after a flood, a pollution incident, etc.).
- Adopt step-by-step plans that show progress along the way. This is more readily accepted than long range goals alone.
- A network of water professionals, and other stakeholders (government officials, researchers, educators, community members, civil society, private sector, etc.) could be established as a mechanism for dialogue and action to address the impacts related to water and climate.
- Routine updating and incorporation of principles for modern water management, as well as improvements in technology where feasible.
- Identification of hot spots or critical areas based on levels of vulnerability.

AGRICULTURE AND FOOD SECURITY

A range of potential adaptation measures have been identified for reducing climate change impacts on the agricultural sector, and on food security in the CARICOM region. Adaptation measures for consideration in agriculture and food security, as developed under ACCC Component 8, are as follows.

Adaptation Options

With generally drier conditions but increased frequency of intense rains, higher temperatures, rising sea level, and more severe hurricanes, a number of adaptation measures should be taken in the Caribbean. It will be noted that many of the proposed adaptation options would be valuable in light of presently experienced variations in climate, and for other non-climate-related reasons. Anthropogenic climate change provides the rationale for, or an additional important reason for, undertaking these measures.

At Farm Level (with National Support)

i) Adopt water conservation measures such as rainwater harvesting and management, drip irrigation techniques, mulching.

ii) Undertake soil conservation measures for erosion prevention (high-intensity rains) – such as terracing and contour plowing on slopes, grassed waterways, etc.

iii) Plant shelterbelts of fast growing trees (e.g., lucena) for protection against strong winds, shade for farm animals, and conserving soil moisture.

iv) Increase the adoption of nutrient management plans and organic farming to minimize chemical pollution of fish and coastal waters in increasing runoff events.

v) Improve construction and design of poultry and other farm animal barns to reduce impacts of higher outdoor temperature and humidity.

Note: To achieve significant adoption of the above measures at the farm level will require extension programs and incentives by national governments.

For Fisheries

vi) Design and construct infrastructure, boats, gear, landing sites, wharves, etc., to be more resilient in severe storms. Artisanal fishers will be required to go further to sea as coastal and coral reef related fisheries are impacted by over-fishing and climate change.

vii) Resilience of fisheries communities should be increased by social organization, such as forming cooperatives.

viii) To partially supplant near-shore fisheries, greater use of mariculture should be introduced but in ways that do not cause significant environmental or ecosystem damage.

ix) To ensure greater resilience of coral reefs and related fisheries to bleaching with high water – temperature episodes, reduce other stresses such as those from land-based pollution, anchoring on corals, etc.

x) Adopt sea weed harvesting for nutritional products as alternative to or to augment coastal fishing.

National Level

xi) Consider feasibility of contributory insurance programs operated by governments for crop losses, and losses of fisheries infrastructure due to natural hazards.

xii) Move towards greater agricultural diversification to reduce vulnerability to overseas market changes, and to increase export earnings, through niche crops such as spices, and through organic farming.

xiii) Explore opportunities to use more endogenous animal feed, e.g., fish wastes, nutrient-rich pastures.

xiv) Uncover traditional knowledge on planting and harvesting in light of climate conditions, and disseminate this knowledge more broadly.

xv) In light of social importance and importance of fish for good nutrition, give higher profile in government to support of fisheries activities in light of climate and other stresses.

xvi) Improve food storage facilities and processing to minimize spoilage under warmer climate.

xvii) Exploit agricultural wastes for non-food products which can reduce greenhouse gas emissions, e.g., ethanol, co-generation.

xviii) In national land-use planning, protect prime agricultural land from encroachment to help ensure food security, and designate hazard lands (floodplains, unstable slopes) for protected or no development. Use current soils knowledge and climate information to encourage most-suitable crops and cropping practices in various parts of each country.

Note: Some projects which also reduce greenhouse gas emissions may be eligible for capital funding from overseas through the clean development mechanism CDM.

Regional

xix) Disseminate knowledge on techniques to make optimum use in agriculture and fisheries of seasonal forecasts of climate and sea surface temperature and of early warming systems. Improve quality and dissemination to local level of seasonal predictions in appropriate format.

xx) Reduce barriers to agricultural trade within the region to reduce dependency on imported foods from overseas. This could be especially effective for corn and rice.

xxi) Seek greater diversity of sources of imported foods to avoid over-dependence on one source which may be affected by climate change. Consider the possibility of regional purchasing policies for major imported foods and products.

xxii) Encourage greater exchange of appropriate agriculture and food technologies in a warming climate between countries of various language groups in the Caribbean.

xxiii) Develop seed banks for important species and strains of plants which could be destroyed in hurricanes or increased pest infestations.

Research and Development

xxiv) Greater understanding through monitoring and research needed of relationship of fish stocks to ocean water temperatures and currents for better prediction of climate change effects.

xxv) Further development and exploration of varieties adapted for salt, heat and drought tolerance.

xxvi) Better understanding of susceptibility of agriculture soils to erosion, with increased high-intensity rains, and dissemination of erosion reduction techniques.

xxvii) Determine temperature and moisture sensitivity of crop pests and diseases and devise integrated pest management strategies that will be effective in a changing climate.

2.8 Step 7: Cost-Benefit Analysis

A cost benefit-analysis should be undertaken to determine the economic viability of proposed adaptation measures (see *Figure 21*). A cost-benefit analysis is a conceptual framework for the evaluation of investment projects. It differs from a straightforward financial appraisal in that it considers all gains (benefits) and losses (costs) regardless of to whom they accrue (although usually confined to the residents of any country). A benefit is then any gain in "utility"; a cost is any loss of utility as measured by the "opportunity cost" of the proposed project. In practice, many benefits or damages are not readily estimable in monetary terms (e.g., destruction of community ties). Costs will be measured in terms of the actual money costs of the project.[1]

2.9 Step 8: Monitoring Program

The EIA team should develop the "Climate Change Monitoring Program" that is established as part of the climate change adaptation program. Such a program should be designed to monitor:

a) climate patterns affecting the project area;

b) climate change impacts on key social, economic and environmental indicators.

The results from the monitoring program will assist in the development of a database to guide, evaluate and refine adaptation measures and will be required for project evaluation activities.

2.10 Step 9: Prepare Final Report

Objective: Finalize a project design, which incorporates management, mitigation and adaptation measures necessary to address natural hazard vulnerabilities and risks identification. Appropriate monitoring programmes outlined.

Process:

- Detailed study report finalized with the results of the hazard and vulnerability assessments.
- Identified management, mitigation and adaptation measures incorporated into project design and description.
- Monitoring programmes developed and incorporated.

Responsibility:

Proponent prepares final report, which includes necessary management, mitigation and adaptation measures.

Climate change adaptation components of this step in the EIA

The purpose of the final EIA report is to convey the results of the various analyses conducted during the assessment and to describe the preferred project alternative, which has been updated to include the management, mitigation and adaptation measures necessary to address the identified natural hazard risks.

In addition, the final report must outline a monitoring program to track actual impacts. Within the context of natural hazards, this monitoring program is critical to ensure that the actual hazard impacts experienced by the project do not differ significantly from the impacts that were estimated in the EIA analyses. The program should be designed to monitor, within the project vicinity:

- natural hazards affecting the area;
- natural hazard impacts on key social, economic and environmental indicators; and
- impacts of the project on natural hazards.

The results from the monitoring program will assist in identifying and addressing unanticipated impacts, in the development of a database to guide, evaluate and refine management, mitigation and adaptation measures and in evaluating project activities. The monitoring program should be incorporated into an enforceable monitoring agreement.

[1]Source - *Environmental Evaluation of Environmental Impacts: A Workbook,* Asian Development Bank, 1996

FIGURE 23 - Costs and Benefits of Building Resilient Infrastructure: the Case of Port Zante in St. Kitts & Nevis

Infrastructure in hazard-prone countries needs to be designed and built so that it can withstand the environmental forces that are expected to affect it over its lifetime. Higher design standards and better construction will reduce the potential for damage from extreme events. How high these design and construction standards should be set will be determined by willingness to pay, and must be weighed against the acceptable level of expected damage, or risk. This can be accomplished with a cost-benefit analysis of different designs during project appraisal, where the cost of the hazard mitigation options is compared against the benefits in terms of net present value of avoided damage over the project's lifetime. In simpler terms, such an analysis would settle the classic argument: is it worth investing more up-front to build a stronger facility, or can we afford to take a chance on the rare occurrence of a disaster?

Port Zante on the island of St. Kitts was nearing completion when it was struck by hurricane Georges in September 1999, and suffered significant damage. Repairs and reconstruction were well underway when the Port was struck a second time, by hurricane Lenny in November of 2000, again with significant damage as a result. In both cases, damage was caused primarily by the action of storm waves, enhanced by a relatively small storm surge.

Photo provided by Jan Vermeiren (OAS)

How big are the losses suffered from both hurricanes?

Information provided by the Port Authority of St. Kitts & Nevis puts the original cost of construction of Port Zante at US$22.5M. Hurricane Georges struck when the project was nearly complete, causing estimated damages of US$10.1M. Payment on insurance claims for material damage and business interruption amounted to US$8.1M. Reconstruction was started shortly afterwards, but was interrupted and by Hurricane Lenny. Damage from that event amounted to US$14.1M, with the insurance paying out US$11.7M.

The cost of reconstruction following Lenny, which is scheduled to be completed by October 2002, is estimated at US$26.2M.

No concrete information was provided on the amount spent on reconstruction for the period between Hurricanes Georges and Lenny, but an estimate of US$4.0M was considered acceptable. Consequently, the government of St. Kitts & Nevis will have spent a total of US$32.9M on construction and reconstruction, net of insurance receipts. This amounts to US$10.4M more than the original construction cost, not counting the insurance premium payments. In addition, there is the loss of revenue and contributions to the national economy that Port Zante could have made had it not been under reconstruction during four years. It is estimated that the Port could have attracted an additional 50 vessels per year, representing around US$0.3M in docking and landing fees, and at least US$2.0M in expenditures in the local economy by passengers and crew.

What could have been done to avoid the losses?

Good practice in building port facilities in the Caribbean is to design the structures to withstand the 1-in-50-year storm. The pier in Plymouth, Montserrat had a similar exposure to hurricanes Georges and Lenny as the piers in Port Zante. It was built in 1993 with a design capable of withstanding the 50-year wave and has not suffered any damage to date. No information could be obtained on the design standard used for the original construction of Port Zante or the reconstruction after Hurricane Georges. The latest reconstruction after Hurricane Luis is led by Novaport, and reportedly was designed for a significant wave height of approximately 5.3m.

High waves are the principal cause of damage to Caribbean port facilities and sea defences. The peak significant wave height at the location of Port Zante was estimated at 7.0m for hurricane Georges and 6.6m for hurricane Lenny[1]. These estimates are within the range corresponding to a 50-year wave for the same location[2]. If the facility had been designed and built from the outset to withstand a 50-year wave, it is highly unlikely that it would have suffered significant damage from either Hurricanes Georges or Lenny.

What would it have cost to design for a higher standard?

To answer this question accurately, one would have to carry out a thorough review of the actual design specifications and original construction documents. This would require some funding, which was not available at the time of this simple exercise. Nevertheless, experience from similar projects throughout the region, and consultations with marine design engineers, put this cost increase in the 10 to 15% range, or around US$3.0M. This amount is less than one third of the net additional cost for rebuilding the port, and only slightly more than the yearly income a fully operational Port Zante would have generated. Doing it right the first time definitely pays.

Jan C. Vermeiren
Unit for Sustainable Development and Environment, Organization of American States
Washington, May 2002

[1] Results of a numerical model simulation of hurricanes Georges and Lenny carried out by Watson Technical Consulting for the OAS, 2001.

[2] The 50-year significant wave height for the location of Port Zante is 6.0m MLE, or 8.9m at the 90% projection limit. See: http://cdcm.eng.uwi.tt This site operated by the University of the West Indies faculty of Engineering allows the user to obtain location-specific estimates for wind, wave and surge hazards for selected return periods.

2.11 Step 10: Project Appraisal

Objective: Determine viability and acceptability of project against established criteria.

Process:

- Technical review by responsible authority against established criteria.
- Approval or rejection of project.
- Responsibility: CDB or responsible authority (national-level).

Climate change adaptation components of this step in the EIA

A project appraisal of the natural hazard components of an EIA must confirm that:

- all potentially significant hazards, as identified in the EIA scoping, have been analyzed using appropriate methodologies;
- appropriate and sufficient management, mitigation and/or adaptation measures have been identified and incorporated into project design for all potentially significant impacts identified in the detailed hazard and vulnerability assessments; and
- it is technically, financially and administratively feasible to implement the necessary natural hazard risk management measures in the proposed project.

A sample project appraisal/review checklist that includes natural hazard considerations is included in *Annex 8*.

2.12 Step 11: Implementation and Monitoring

The project proponent is responsible for ensuring that the project is developed in accordance with the provisions of the "Environmental Management Plan," "Climate Change Adaptation Program" and "Climate Change Monitoring

Program" that comprise part of the EIA. The EIA Administrator shall ensure that regular reports are submitted by the project proponent outlining the results of any monitoring that has been undertaken. The EIA Administrator should also consult with the National Climate Change Focal Point (established under the United Nations Framework Convention on Climate Change) to:

a) monitor any changes in climate that may impact upon project implementation; and
b) provide guidance to the project proponent on any changes that may be required to the monitoring program.

SECTION 3 Cumulative Effects*

3.0 Introduction

A conventional project and site-specific approach to environmental impact assessment has its limitations when assessing potential cumulative climate change impacts or effects. This is because the impact of any single climate change event may be considered insignificant when assessed in isolation, but may be significant when evaluated in the context of the combined effect of all reasonably foreseeable future climate change events that may impact on the project/activity in question. For this reason, the explicit assessment of cumulative effects is considered essential to the integration of climate change adaptation into the environmental impact assessment process. Although cumulative impacts can result from either multiple development and/or climate change impacts over space and time, the primary focus of this section will be on cumulative climate change impacts and their interactions.

3.1 Cumulative Effects Defined

Cumulative effects are changes to the environment that are caused by an action/event in combination with other past, present and future human actions and events. A cumulative effects assessment is an assessment of those effects. In practice, the assessment of cumulative climate change effects requires consideration of some concepts that are not always found in conventional approaches followed in environmental impact assessments. Specifically, cumulative effects assessments are typically expected to:

- assess effects over a larger (i.e., "regional") area that may cross jurisdictional boundaries [includes effects due to natural perturbations affecting environmental components and human actions];
- assess effects during a longer period of time into the future;
- consider effects on Valued Ecosystem Components (VECs) due to interactions with other actions, and not just the effects of the single project under review;
- include other past, existing and future (e.g., reasonably foreseeable) actions and events; and
- evaluate significance of other than just local, direct effects (e.g., climate change effects on trade and tourism).

Many environmental impact assessments have focused on a local scale in which only the "footprint" or area covered by each action's component is considered. Some environmental impact assessments also consider the combined effects of various components together (e.g., coastal development, shore-front protection, and impacts on coastal ecosystems). A cumulative effects assessment further enlarges the scale of the assessment. For the practitioner, the challenge is determining how large an area around the action should be

*Adapted from "Cumulative Effects Assessment in Environmental Assessment." *Environmental Assessment Guidelines.* Asian Development Bank (ADB). 2003, and *Cumulative Effects Assessment Practitioners Guide*, Canadian Environmental Assessment Agency. 1999.

assessed, how long in time, and how to practically assess the often complex interactions among the actions or events. In all other ways, cumulative effects assessment is fundamentally the same as environmental impact assessments and, therefore, often relies on established EIA practice.

3.2 Cumulative Climate Change Effects Assessment and the Environmental Impact Assessment Process

Cumulative effects generally refer to impacts that are additive or interactive (synergistic) in nature and result from multiple activities over time, including impacts from the project/activity that is the subject of the environmental impact assessment. An assessment of such effects is a critical element when addressing climate change considerations in view of the diversity of impacts (e.g., changes in precipitation, temperature, frequency of extreme events, etc.) and the protracted time horizon that must be considered.

In the context of climate change, it must be recognised that cumulative effects:

i) are caused by the aggregate of past, present and future events acting upon the natural and human environment as altered by ongoing natural and anthropogenic activities;

ii) are the total effect, including both direct (e.g., sea-level rise) and indirect effects (coastal flooding arising from sea-level rise) on a given resource, ecosystem and human community;

iii) need to be analysed in terms of the specific resource, ecosystem, and human community being affected;

iv) cannot be practically analysed beyond a reasonable boundary – the list of climate change effects must focus on those that are meaningful and that occur within a practical time frame;

v) may result from the accumulation of similar impacts (e.g., several years of drought) or the synergistic interaction of different impacts (e.g., sea-level rise, flooding from increased precipitation, and increased storm surge accompanying hurricane activity);

vi) will last for many years beyond the life of the project;

vii) should be assessed in terms of the capacity of the affected resource, ecosystem, and

FIGURE 24 - Examples of Cumulative Climate Change Effects

Atmosphere: combined SO_2 and NO_x emissions with increased temperature and heavy rains resulting in an increase in human health impacts (acid deposition, ozone-smog episodes).

Hydrology and Water Resources: combined reductions in flow volumes from changes in precipitation and increased evaporation from higher temperatures, that are aggravated within a particular river basin due to irrigation, municipal industrial water withdrawals and land use changes.

Ecosystems and their Goods and Services: coral reef mortality within a given marine management unit from increased water temperatures, and deteriorating resilience of the coastal ecosystem to ongoing anthropogenic activities.

Soils and Land Resources: loss of productive arable land due to several seasons of drought, and/or higher intensity erosion causing rainfalls, compounded by anthropogenic activities (uncontrolled encroachment of urban development).

Human Settlements: loss of housing in low-lying coastal areas due to sea-level rise and storm surge from increased frequency of extreme events.

Insurance and Other Financial Services: increased losses due to successive seasons of floods, droughts and extreme events.

Human Health: changes in precipitation and temperature patterns affecting the incidence and location of outbreaks of vector-borne and respiratory diseases.

Socio/economic Development: impacts of loss of revenue to fisherfolk, agriculture sector employees and tourism sector resulting from sea level rise, changes in climate patterns (precipitation, temperature, extreme events), and resulting damage or reduced resilience of natural ecosystems.

human community and their adaptive capacity to such climate change impacts.

Assessment of cumulative effects is increasingly seen as representing best practice in conducting environmental impact assessments.

Cumulative effects occur as interactions between actions and events, between actions/events and the environment, and between components of the environment. These "pathways" between a cause (or source) and an effect are the focus of an assessment of cumulative effects. The magnitude of the combined effects along a pathway can be equal to the sum of the individual effects (additive effect) or can be an increased effect (synergistic effect).

Examples of cumulative climate change effects are provided in *Figure 24*.

3.3 Cumulative Climate Change Effects Assessment

Ideally, cumulative climate change effects should be assessed relative to a goal in which the effects are managed. Terms such as ecological carrying capacity, ecosystem integrity or resilience, long-term population viability and sustainable development are often cited as goals to be accomplished by cumulative effects assessments. What these terms represent are important and their successful implementation would substantially improve the value of an assessment and significantly contribute towards the implementation of a successful climate change adaptation plan.

However, expectations of what should be accomplished in a cumulative effects assessment (CEA) often exceed what is reasonably possible given our knowledge of climate change impacts, the resilience of natural ecosystems, available information, level of effort required to obtain more information, and the limits of analytical techniques in predicting the effects of climate change events on the environment. These terms should not be used in a CEA unless they are carefully defined; otherwise, the uncertainty associated with their meaning will later bring into question the usefulness of the cumulative effects assessment.

Ideally, all aspects of a cumulative effects assessment are done concurrently with the environmental impact assessment, resulting in an assessment approach that makes no explicit distinction between the two "parts." In practice, however, the substantive work in a cumulative effects assessment is often done after the initial identification of effects have been completed in an environmental impact assessment. In this way, the early identification of direct project effects "paves the way" for cumulative effects to be assessed.

The process of analysing cumulative climate change effects is an enhancement of the traditional environmental impact assessment (see *Section 2*) components: i) Preliminary Vulnerability Assessment (*Step 2*) ii) Scoping (*Step 4*), and iii) Assessment and Evaluation – describing the affected environment and determining the consequences (*Step 5*). Generally, it is also critical to incorporate cumulative impacts analysis into the development of adaptation alternatives (*Step 6*), since it is only by identifying and modifying alternatives in the light of the projected cumulative impacts that adverse consequences can be effectively addressed.

The following text is not intended to be an authoritative guide to cumulative effects assessments since such guidance documents are readily available[1]. What is presented below is step-by-step guidance on key issues and questions that need to be considered when undertaking cumulative climate change effects assessments.

3.3.1 Preliminary Vulnerability Assessment

(See Section 2.3)

The cumulative effects assessment is initiated through the identification, as part of the Preliminary Vulnerability Assessment, of future climate change events and conditions (or combinations of such events and conditions) that may impact the proposed project/activity. During initial screening of the project, the project team should identify and evaluate potential cumulative impacts from climate change on the project's area of influence. The following questions should be considered during screening, and answered more fully during project preparation/evaluation.

[1]See *Cumulative Effects Assessment Practitioners Guide* Canadian Environmental Assessment Agency. 1999, and *Framework for Cumulative Risk Assessment*. National Centre for Environmental Assessment, United States Environment Protection Agency. 2003.

1) What are the foreseeable and likely cumulative climate change impacts that may affect the project?

The range of climate change impacts should have been identified utilizing the process outlined in *Section 2*. The cumulative effects assessment requires that the combined effect of all reasonably foreseeable future climate change events that may impact on the project/activity in question be identified and assessed. There are two main causes of uncertainty in such analyses. Firstly, the identification of foreseeable effects from climate change events on the project/activity *within a reasonable time frame*, and secondly the identification of likely combinations of climate change events and impacts within the given period of time.

"How far ahead in the future" to consider in a cumulative climate change effects assessment depends on what the assessment is trying to accomplish. Comparison of incremental changes over time requires the use of historical records for establishing an environmental baseline. The possibility of new events requires the need to look ahead into the future. The use of climate change scenarios (see *Section 2*) provides a useful approach to determining temporal boundaries. Scenarios represent a point in time with specific disturbances and environmental conditions. Incremental changes between scenarios can then be compared to assess the relative contribution of various actions to overall cumulative effects within the study area.

In practice, temporal boundaries often reflect the operational life or phases of the project under review (e.g., exploration, construction, operations, abandonment). The temporal boundary traditionally used in cumulative effects assessments are often associated with a single year or range of years according to the operational phases of the project under review. (e.g., 2003-2050). For the purpose of undertaking the cumulative climate change effects assessment it is recommended that temporal boundaries and time-dependent changes in discrete units of time (e.g., as sequential time scenarios) be consistent with internationally recognised periods for assessing climate change impacts (i.e., tri-decades centred on the 2020's (2010-2039), 2050's (2040-2069), and 2080's (2070-2099)). It is considered that climate scenarios based on the 2020, 2050, and 2080 timeframes will provide the most useful basis for undertaking the cumulative climate change effects assessments. Selection of future climate change events (or combinations of such events) must consider the certainty of whether the event (or combination of such events) will actually occur. The evaluation should categorize future climate change events into three types, which, for uniformity, should be based on the three levels used by the Intergovernmental Panel on Climate Change (2001) to categorize climate projections:

- **Very Likely** (>90% chance) – The event (or combination of events) will occur or there is a high probability the event (or combination of events) will occur.
- **Likely** (66-90% chance) – The event (or combination of events) may occur, but there is some uncertainty about this conclusion.
- **Moderately Likely** (33-66% chance) – There is considerable uncertainty whether the event (or combination of events) action will ever occur.

The selection of future climate change events to consider should at least reflect the most certain scenario and, at best the most likely future scenario. Although requiring interpretation on a case-by-case basis, the selection of future climate change events (or combination of such events) will be a compromise between under-representing the full extent of future change and identifying and assessing an unreasonably large number of events (or combinations of such events). It is suggested that the process for "Estimating Frequency or Probability of an Event" and "Estimating Severity of the Impacts" as articulated in the *Caribbean Risk Management Techniques for Climate Change* (2003) be used to identify project and environmental components that are at high risks/impacts from cumulative climate change impacts that would warrant further quantification through the development of

project relevant climate change scenarios for identified high risk.

2) How are likely combinations of climate change events and impacts determined?

Global-scale events such as climate change must be assessed on the basis of likely significant impacts that may affect the project under consideration. However, in recognition of the complexities and often practical difficulty of scoping these events and effects (and combinations of climate change events over a given period of time), the cumulative effects assessment should at least identify the contributing causes, attempt to quantify the magnitude of the event's contribution, and suggest appropriate adaptation responses. In this way, decision-makers can account for the climate change event's contribution within broad national programs and initiatives.

However, there remain the realities of the cause-effect relationships (known and perceived) caused by the climate change event (or combinations of such events). The practitioner must determine at what point an event is trivial or insignificant. The concept that such a point is reached at a certain threshold is attractive but often difficult to define (especially quantitatively) except for cases in which regulated or recommended levels provide a point of comparison (e.g., water quality standards). The complexity of any relationship beyond those purely at the physical-chemical level often results in considerable reliance on best professional judgement and the consideration of risk. An adaptive approach should be followed when setting boundaries, in which the first boundary, often arrived at by an educated "guess," may later change if new information suggests that a different boundary is required.

Some climate change events may have to be assessed generically because there are too many to practically characterize individually. This may be the case if there are many small events suspected of causing minimal effects due to short-duration, low-magnitude, irregular and unpredictable occurrences, or temporary duration. If there are numerous events, it helps if they are organized by some categories in recognition of the similar types of effects they may cause. For example, they can be organized by:

- nature of event over period of time (e.g., floods, droughts, hurricane activity, increased precipitation intensities during 2000-2020 year period);
- combination of climate change events on single sector (e.g., flood, drought and erosion impacts upon agricultural sector during 2000-2020 year period, sea-level rise and impacts from extreme events upon coastal resources during 2000-2020 year period);
- combination of events in a single year on multiple sectors.

In such cases, the preliminary vulnerability assessment must rely on publicly available information as much as possible. Any limitations this places on the assessment must be clearly stated. If no or little information is available, it is difficult to predict cumulative effects unless the practitioner assumes certain project attributes. These assumptions should be clearly stated, and the uncertainty this causes in the assessment should be explained. A reasonable attempt to collect information must at least be demonstrated. Lack of usable information about other actions can have important implications to the certainty associated with predictions made in a CEA.

3.3.2 Scoping

(See Section 2.5)

This scoping step is important, as it assists the practitioner in beginning to understand one of the most fundamental cumulative effects assessment questions: what is affecting what**?** Good scoping in the initial stages of the study will mean that the assessment effort will focus on the most likely effect's pathways of concern.

One approach to accomplishing this, a common step in many EIAs, is to first identify components (e.g., air, water, biodiversity, human health) that may be affected by various aspects of climate change impacting upon the project being assessed. Then, environmental and climate change components that may be affected by other actions in the region of interest (e.g., other anthropogenic

activities within the spatial boundary) can be identified. The scoping could then proceed to focus on the relationships between specific impacts from various climate change events and specific ecosystem components.

3.3.3 Assessment and Evaluation

(See Section 2.6)

A matrix, describing various attributes affecting each valued ecosystem component is then completed. The attributes are: existing stressors affecting the valued ecosystem component; pathways of change (cause-effect linkages); consequences (i.e., resulting trends of valued ecosystem components); and contribution of the action to overall changes. Adaptation measures are also identified.

The effects are evaluated, using best professional judgment, by asking if the identified changes affect the integrity of the environment. These changes are then compared with existing goals (e.g., ecological carrying capacity, ecosystem integrity or resilience).

All information is documented, uncertainties identified, and feedback and monitoring requirements identified for inclusion in the final report.

3.4 Adaptation Plan

(See Section 2.7)

Managing cumulative effects in a cumulative climate change effects assessment requires, as a start, the same type of adaptation and monitoring measures that would be recommended in an EIA. Adapting to a local effect as much as possible is the best way to reduce cumulative effects;

FIGURE 25 - Scoping: A Series of Questions to be Asked

- *Are the potential impacts of the climate change event (or combinations of events), as well as other existing stressors, occurring so closely over time that the recovery rate of the system is being exceeded or resilience of the ecosystem irreparably affected?*
- *Are the potential impacts of any single climate change event, along with other stressors from other climate change events, occurring so close together within a geographical area that their effects overlap?*
- *Could the impacts from combinations of climate change events interact among themselves, or interact with other existing or known future stressors, either additively or synergistically?*
- *Do the potential impacts of the climate change event (or combinations of events) affect key components of the environment? Have those components already been affected by other stressors from the same or other actions, either directly, indirectly or through some complex pathway?*
- *Is the climate change event one of many of the same type (e.g., drought), producing impacts which are individually insignificant but which affect the environment in such a similar way that they can become collectively important over the longer term?*

If the answer to any of these questions is yes, there is a potential for cumulative climate change effects. The following are then also asked:

- *What are the potential impacts of the climate change event that could give rise to cumulative effects?*
- *What is the appropriate scale to consider those impacts?*

FIGURE 26 - Assessment and Evaluation

In the evaluation, the following questions should be considered:

- *What are the key components (e.g., water, soil, air, biodiversity, human health) that may be affected?*
- *What parameters are best used to measure the effects on the environmental components?*
- *What determines the present condition of key environmental components?*
- *How will the proposed project in combination with anticipated cumulative climate change events affect their condition?*
- *What are the probabilities of occurrence, probable magnitudes and probable durations of such cumulative climate change events?*
- *How much further effect could key environmental components sustain before changes in condition can not be reversed?*
- *What degree of certainty can be attached to the estimates of occurrence and magnitudes of these predicted cumulative climate change events?*

however, to be most effective, adaptation and monitoring programs must be long term and regionally based. [Another response to addressing effects is compensation (usually financial) for losses in some form to a person or personal property. Compensation, however, is not adaptation.] This can be costly, require a few years to complete, and require broader data collection and decision-making involvement than has historically been the case with EIAs (monitoring programs for individual actions are usually designed with the involvement of national administrative bodies).

The adaptation measures applied in cumulative effects assessments may be considerably different from those applied in traditional EIAs. These adaptation measures can be applied to developments other than the proposed development (e.g., through the establishment of integrated water resource management plans). Several administrative jurisdictions and stakeholders will usually fall within an assessment's study area. In many cases, the co-operation of these other interests may be required to ensure that recommended adaptation measures are successfully implemented. Effective CEA adaptation planning and management, therefore, often imply the need for national stakeholder involvement to solve national concerns. Considerable reliance is placed on national efforts to implement adaptation programs for cumulative climate change effects, such as initiatives to create co-ordinating bodies that direct or recommend further land use, monitoring and other effects-related research. Participants are usually selected from government departments, stakeholder groups and commercial interests. The objectives of these initiatives are generally to protect ecosystems that are under stress, and disperse permanent and transient human activities to reduce the magnitude of cumulative effects.

Recommendations for national initiatives of this type may be the only means of addressing and adapting to complex cumulative effects issues. It is generally unreasonable to expect a single proponent to bear the burden of adaptation measures to address effects attributable to other actions and events in the region. Often it is more practical and appropriate for regulatory agencies to initiate and help implement these national initiatives, with project proponents providing data relevant to their project's effects.

3.5 Where is the Cumulative Effects Assessment (CEA) Placed in the Environmental Impact Assessment Submission?

There are at least four options for placing the cumulative effects assessment:

- within a separate "CEA chapter" after the EIA portion (this is the most common approach);
- as a stand-alone document, separately bound from the EIA report;
- integrated within the EIA as a unique sub-section, appearing at the end of each major section assessing effects on major environmental components (e.g., water, air, vegetation); or
- fully integrated with the EIA as cross-sectoral issues are raised and examined.

The approach taken will depend on the practitioner's philosophy of cumulative effects (i.e., as inseparable from the EIA or as a unique and different view) and on which approach is most readily accomplished given the division of labour used in assembling the assessment report.

SECTION 4 Integration of Climate Change Considerations into EIAs at the National Level – Caribbean

4.0 Background

A review of existing EIA systems in the CARICOM states[1] shows that very few of the countries have established formal mechanisms for assessing the impacts of climate change on the environment. The existing EIA practice in the CARICOM states involves following the traditional approach to undertaking EIAs, which focuses on the assessment of the impacts of proposed projects or activity on the environment.

In order for CARICOM states to satisfy the mandate provided by Article 4 (1) (f) of the *United Nations Framework Convention on Climate Change* (UNFCCC) there is the need to develop and strengthen EIA systems in these countries. The table below (*Figure 27*) provides a summary of the status of the incorporation of climate change impacts into EIA systems in the CARICOM states.

As a general rule, most of the CARICOM states consider climate change impacts on proposed projects and activities on an *ad hoc* basis. Climate change impacts are usually considered, for example, in respect of impacts associated with sea level rise. Only two of the twelve CARICOM countries, Grenada and Trinidad and Tobago, have developed formal mechanisms for assessing the impacts of climate change. In practice, all the other CARICOM countries consider the likely impacts of climate change on the natural resources and

FIGURE 27 – Status of EIA Procedures Incorporating Climate

COUNTRY	Are there formal EIA mechanisms for assessing the Impacts of Climate Change
Antigua & Barbuda	No
Bahamas	No
Barbados	Yes
Belize	No
British Virgin Islands	No
Cayman Islands	No
Dominica	No
Grenada	Yes
Guyana	No
Jamaica	No
St. Kitts	No
St. Lucia	No
St. Vincent	No
Trinidad and Tobago	Yes

[1]*Review of Environmental Impact Assessment (EIA) Procedures in CARICOM States Participating in the Adapting to Climate Change in the Caribbean (ACCC) Project*, D. F. Oderson. (2003).

sensitive ecosystems on a case-by case-basis.

In Trinidad and Tobago the considerations and Terms of Reference (ToRs) for a particular EIA are influenced by several factors which include scale, nature of proposal, location, etc. Climate change impacts are considered in this context. The particular EIA depends on the agreed ToRs and while there are no prescribed criteria governing the content, style etc., of EIA reports, consideration is given to international standards such as those contained in the World Bank EIA Guidelines.

In Grenada the EIA review committee uses the relevant information relating to climate change impact for specific projects when establishing ToRs and making a determination on EIA proposals.

4.1 Possible Mechanisms for Incorporating Climate Change Considerations into the EIA Process at the National Level

The incorporation of climate change considerations into the EIA process in the CARICOM states may be achieved through the adoption of the following measures:

1. The establishment of formal EIA procedures.
2. The provision of clear criteria for screening and scoping environmental impacts.
3. The provision of clear EIA guidelines for the preparation of EIA reports.
4. The provision of clear criteria governing EIA experts.

4.1.1 Establishment of Formal EIA Procedures

An informal and *ad hoc* approach to undertaking EIA does not facilitate or encourage the systematic assessment of climate change impacts on proposed projects and activities. Seven of the twelve CARICOM states have established legal provisions governing EIA procedures. The majority of these enactments deal with physical planning while the remainder focus on environmental protection, conservation and management.

The enactment of EIA legislation gives certainty and clarity to the EIA process. It provides a framework for regulating, administering and managing EIAs. The legislation allows for the clear identification of the obligations and duties of the proponent and government agency responsible for administering the EIA process. As a result it removes the uncertainty and arbitrariness associated with *ad hoc* and informal EIA procedures.

4.1.2 Provision of Criteria for Screening & Scoping Environmental Impacts

The screening of projects and activities is a critical aspect of the EIA process. The provision of clear criteria for the screening of proposed development (see *Section 2*) may ensure that all projects and activities which are likely to be significantly affected by climate change impacts are carefully assessed with a view to preventing or reducing the impacts.

The scoping exercise (see *Section 2*) is used to prepare the terms of reference and scope of works for the conduct of the EIA study. As a result the provision of clear criteria such as checklists will ensure that the scoping process identifies the significant climate change impacts on the proposed project or activity. The development of a checklist can assist with the review and evaluation of the EIA report.

4.1.3 Provision of EIA Guidelines for the Preparation of EIA Reports

Although all the CARICOM states give some guidance to proponents for the preparation of EIA report only seven of these countries have developed formal EIA guidelines and procedures. The EIA guidelines and procedures are contained in EIA regulations or as EIA manuals. The EIA guidelines and procedures ensure that the contents of EIA reports address all the necessary issues in order to prevent or reduce the impacts associated with the proposed project or activity.

The development of clear EIA guidelines and procedures can therefore be used to ensure that the EIA process and report address climate change impacts. In Guyana and Jamaica, EIA guidelines have been developed for specific sectors. Model EIA guidelines can be developed to address the issue of climate change. The model guidelines for climate change should be flexible enough to allow each CARICOM state to adapt the guidelines to suit its own national circumstance and priorities.

4.1.4 Provision of Criteria Governing EIA Experts

None of the CARICOM states have established a roster of EIA experts even though several of the countries have developed legislation governing the qualification, skills, knowledge and experience which must be possessed by persons conducting EIA. This approach may be used to ensure that persons conducting EIAs and assessing climate change impacts possess the requisite qualification, skills, knowledge and experience on climate change and adaptation policies and measures. The same standard will have to be applied to government experts who review and assess EIAs.

4.2 Integration of Climate Change Adaptation into the EIA Process within CARICOM Countries – Practical Considerations

The following section provides an overview of the environmental impact assessment (EIA) process and procedures in CARICOM countries[2], and identifies, on a country-by-country basis, mechanisms whereby climate change adaptation considerations can be integrated into such processes and procedures.

4.2.1 Antigua and Barbuda

There is no express statutory basis for requiring EIAs in Antigua and Barbuda. In practice, consideration of environmental impacts on development occurs through planning legislation. A new *Physical Planning Act* has been prepared and will establish a formal EIA process. This proposed Act defines EIA as:

"The process of collection, analysis, evaluation and review of information on the likely effects of a proposed development on the environment and the means to overcome adverse effects which enables the Authority to determine whether development permission should be granted and with what conditions, the procedure for which is prescribed in regulations made under this Act."

Section 23 of the proposed *Physical Planning Act, 2002* stipulates that an EIA must be carried out in respect of an application for a development permit for development activities listed in the Third Schedule of the Act.

Notwithstanding the mandatory class of proposals which requires an EIA, the Development Control Authority (the "Authority") has the discretion under s. 23(2) to request an EIA in respect of applications for development not listed in the Third Schedule. In making this decision the Authority should give regard to:

- the nature of the proposed development
- the geographical scale and location
- the extent of the changes to the environment likely to be caused by the proposed development
- the degree of scientific uncertainty
- any development plan for the area.

The proponent may enquire of the Authority in writing whether an EIA is required. Where the Authority determines that an EIA is needed it must notify the proponent of this in writing within 60 days of the receipt of an application for a development permit. The Authority has the responsibility for setting out the ToRs for the EIA and the time frame within which it must be submitted.

The applicant is required by s. 23(5) to submit an EIA statement in such form and containing such information as may be prescribed in EIA regulations. Once an applicant has been notified by the Authority about the need for conducting an EIA, there is a statutory duty on the Authority and other public agencies, if requested, to facilitate consultation with the developer to ensure access to information under the agency's control.

In addition, the Authority has a duty to notify any other agency or Government department having responsibility for the issue of any licence, permit, approval, consent or other document of authorization in connection with any matter affecting the proposed development. Once the agency or government department has been notified accordingly it is prohibited from granting the licence, permit, approval, consent or other document.

The Authority is prohibited under s.23 (7) from granting a development permit unless the EIA is taken into consideration. The Minister is empowered under s. 23(10) to cause a register to be complied of persons with the

[2]Based on *Review Of Environmental Impact Assessment (EIA) Procedures in CARICOM States Participating in the Adapting to Climate Change in the Caribbean (ACCC) Project*, D. F. Oderson, (ACCC) 2003.

requisite qualification, skills, knowledge and experience to carry out EIAs. Any person who is on the register is deemed by the Act to be approved by the Minister to prepare EIAs for Antigua and Barbuda.

Section 85 (2) (g) of the draft *Physical Planning Act* authorizes the Minister to make regulations to provide for the procedures for EIA and the form of EIA statements. There are draft EIA Regulations for Antigua and Barbuda which are not yet in force. The EIA Regulations prescribe procedures for conducting and reviewing EIAs. They prescribe the form and minimum content of EIAs which include:

- a description of the proposed development
- a description of the potentially affected environment
- a description of practical alternatives
- an assessment of the likely or potential environmental impacts
- an identification and description of mitigation measures and alternatives
- an indication of gaps in knowledge and uncertainties which may be encountered during EIA
- an indication of whether the environment of any other State or areas beyond the national jurisdiction is likely to be affected by the proposed development or alternatives
- a brief non-technical summary of the information provided under the above headings.

Integrating Climate Change Adaptation Considerations into the EIA Process

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the EIA process in Antigua and Barbuda.

a) Revision of Definition of EIA

It is recommended that the definition of EIA under the *Physical Planning Act* be revised to also address the impacts of the environment (i.e., climate change) on the project.

b) Establishment of Formal EIA Procedures

It is recommended that legislation (*Physical Planning Act* and *EIA Regulations*) be enacted to provide certainty and clarity to the EIA process, and to provide a framework for regulating, administering and managing EIAs. Such legislation should allow for the clear identification of the obligations and duties of the proponent and the Development Control Authority as the government agency responsible for administering the EIA process.

c) Provision of Clear Criteria for Screening & Scoping Environmental Impacts

It is recommended that an EIA Manual be developed to provide clear criteria and checklists for screening and scoping to ensure identification of the significant climate change impacts on the proposed project or activity. The development of such checklists can assist with the review and evaluation of the EIA report.

d) Provision of Clear EIA Guidelines for the Preparation of EIA Reports

It is recommended that an EIA Guide be prepared to assist developers and EIA practitioners in undertaking the EIA process. Such a Guide should ensure that the EIA process addresses climate change impacts. The provision of Model Terms of Reference for addressing climate change adaptation considerations would also assist applicants undertaking an EIA, and ensure consistency in approach.

e) Provision of Clear Criteria Governing EIA Experts

It is recommended that criteria be established governing the qualification, skills, knowledge and experience which must be possessed by persons conducting EIA. This approach may be used to ensure that persons conducting EIAs and assessing climate change impacts possess the requisite qualification, skills, knowledge and experience on climate change and adaptation policies and measures. The same standard will have to be applied to government experts who review and assess EIAs.

The EIA Regulations provide for the conducting of an initial environmental evaluation before ToRs are finalized. The Authority is required to publish a notice of commencement of the EIA in the *Gazette* and post it in the area of the proposed development.

During the course of the EIA the Authority has the discretion to require the applicant to undertake

consultation with interested members of the public with a view to providing project information and to record the concerns of the community. The Authority has the power under the EIA Regulations to prescribe the procedures for the public consultation.

When the EIA statement has been submitted the Authority has the responsibility to examine it to ensure it conforms with the ToRs. Where the EIA statement is inadequate the Authority may require the applicant to conduct further work and amend the EIA. The Authority and the applicant must agree on the new deadline. The Authority must facilitate public access to the EIA once it has received it.

Under the draft legislation the Minister responsible for Physical Planning has oversight of the EIA process. The Minister is empowered to make regulations to govern the process of conducting and reviewing EIAs. In addition the Minister also has the discretion to approve a register of EIA practitioners. The Development Control Authority is responsible for administering and implementing the EIA procedures.

4.2.2 The Bahamas

Although there is no legislation providing for environmental impact assessments in Bahamas, the government is presently considering the development of EIA legislation. However, the Department responsible for physical planning may request an EIA depending upon the nature of the proposed project. EIAs are undertaken by administrative directive, and are undertaken for major development proposals that may alter the physical landscape of a particular environment. The Town Planning Committee is responsible for land use development applications and associated EIAs. The Director of Planning, as technical advisor to the Town Planning Committee, reviews EIAs and makes recommendations.

The Bahamas Environment Science and Technology (BEST) Commission, which was established in 1994, is responsible for EIAs. The BEST Commission currently is a part of the portfolio of the Ministry of Health and Environment, and has been given

Integrating Climate Change Adaptation Considerations into the EIA Process

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the EIA process in The Bahamas.

a) Establishment of Formal EIA Procedures

It is recommended that legislation be enacted to provide certainty and clarity to the EIA process, and to provide a framework for regulating, administering and managing EIAs. Such legislation should allow for the clear identification of the obligations and duties of the proponent and the BEST Commission as the government agency responsible for administering the EIA process.

b) Provision of Clear EIA Guidelines for the Preparation of EIA Reports

It is recommended that the sector Guidelines currently being developed by the BEST Commission ensure that the EIA process address climate change impacts. The provision of Model Terms of Reference for addressing climate change adaptation considerations would also assist applicants undertaking an EIA, and ensure consistency in approach.

c) Provision of Clear Criteria for Screening & Scoping Environmental Impacts

It is recommended that the sector guidelines currently being developed by the BEST Commission provide clear criteria for screening and scoping to ensure identification of the significant climate change impacts on the proposed project or activity. The development of such checklists can assist with the review and evaluation of the EIA report.

d) Provision of Clear Criteria Governing EIA Experts

It is noted that the BEST Commission has established criteria governing the qualification, skills, knowledge and experience which must be possessed by persons conducting EIA. This approach may be used to ensure that persons conducting EIAs and assessing climate change impacts possess the requisite qualification, skills, knowledge and experience on climate change and adaptation policies and measures. The same standard will have to be applied to government experts who review and assess EIAs.

the mandate to advise Government in a timely fashion on the environmental impact of various development proposals submitted for the Commission's review, and to conduct site visits for projects under EIA review. The BEST Commission, which comprises representatives of various government agencies, serves as an EIA coordinating agency. In this capacity, the BEST Commission coordinates the review, assessment and monitoring of EIAs.

There are no prescribed categories of projects which trigger the EIA process. The BEST Commission uses *Resort Development Guidelines* and proponents are often advised to follow the format of these guidelines for the development of EIAs. The BEST Commission is currently developing EIA Guidelines in the following sectors:

- Housing Developments
- Marina & Ports
- Agricultural Developments & Operations
- Industrial Operations
- Energy Industries
- Manufacturing
- Extractive Processing
- Development in Sensitive Areas
- Aquaculture and Mariculture Developments.

All non-Bahamian and/or foreign companies seeking to provide EIA services in The Commonwealth of the Bahamas are required to have the following prior to commencing any related activities leading to the development of an EIA document for review:

1. Pre-Approval by the BEST Commission to produce an EIA Document
2. Local Business License
3. Work Permits for all persons involved in the production of the EIA document.

All local companies seeking to provide EIA services require pre-approval by the BEST Commission in addition to the following:

1. Current Business License
2. Valid work permits for all foreign persons involved in the production of the EIA document.

Public participation in the EIA process is generally encouraged through public meetings and consultations with agencies outside the review process. EIA reports are generally not made available to the public except where public meetings are held as part of the EIA process.

4.2.3 Barbados

There is no expressed legal provision for undertaking EIAs in Barbados. In practice, s. 17 (1) of the *Town and Country Planning Act*, Cap 240 is used by the Chief Town Planner to request applicants for development permission to submit EIAs. Section 17 (1) provides that: *"…the Chief Town Planner may by notice in writing sent to the applicant require such information as he thinks fit."*

In 1998 the Government of Barbados undertook a comprehensive review of its environmental management and physical planning framework in a study entitled *Environmental Management and Land Use Planning for Sustainable Development* (EMLUP). One of the recommendations of this study is related to the establishment of an EIA process in Barbados. Although the EMLUP study proposed a new *Environmental Management Act* (EMA) the recommendation was made to locate the EIA process within the *Town and Country Planning Act* (TCPA). Three specific EMLUP recommendations relate to:

1. Amendment to the *Town and Country Planning Act* (TCPA)
2. Preparation of EIA Guidelines and
3. Establishment of an EIA Review Panel.

The EMLUP study has recommended that amendments be made to the TCPA to authorize the Chief Town Planner and the proposed Chief Environmental Officer to require EIAs for proposed developments. It is recommended that the Physical Development Plan should contain a list of classes of development for which an EIA is required. It is recommended that the Chief Town Planner should provide guidelines for conducting and reviewing EIAs. The guidelines should provide for:

- Terms of Reference for preparation of EIAs
- Consultation with government agencies and the public
- Designation of an EIA Review Panel.

Draft EIA Guidelines have been prepared which are used in practice for conducting and reviewing EIAs in Barbados. The Chief Town Planner is currently preparing final EIA Guidelines which will take into consideration

the existing draft. The existing draft EIA Guidelines seek to clarify the following concerns with the EIA process:

1. Environmental Evaluation – it is recommended that government should use a flexible process to streamline and limit the scope of EIAs and the time frame
2. Triggering Mechanism – three triggers have been recommended: (i)a mandatory list of projects which automatically require an EIA; (ii) the Chief Town Planner and the Chief Environmental Officer should have the discretion to trigger an EIA on a case by case basis; (iii) the developer should be able to initiate an EIA.
3. The role of the proponent and government reviewers.
4. Terms of Reference – it is recommended that the proponent should prepare the ToRs and submit them to the Review Panel for consideration and approval. In practice the ToRs are prepared by the Chief Town Planner after consultation with relevant government agencies.
5. Pre-submission – proponents are encouraged to meet with relevant government agencies which have an interest in the proposal as early as possible to identify the specific concerns of the individual respective agencies.
6. Public Consultation – it is recommended that regulations to the TCPA be developed to allow for public consultation on applications involving EIAs.
7. Conditions of approval – it is recommended that conditions of approval for development should require the proponent to carry out: all mitigation measures proposed by the EIA; monitoring to verify impacts are being controlled; regular reporting to particular technical agencies; immediate reporting where monitoring shows that the development is in significant non-conformity with standards; implementation of contingency measures where mitigation measures are not working.
8. Submission and Approval of EIA – it is recommended that upon completion of the EIA, the proponent submit the EIA report to the Review Panel which may make one of three decisions: (i) approve the EIA as satisfactory thereby enabling a planning decision to be made by the Chief Town Planner or Minister; (ii) require proponent to provide further information; (iii) reject the EIA and recommend that a refusal of planning permission be made by Chief Town Planner.
9. Economic Impact Assessment – it is recommended that economic and financial considerations should be incorporated into the EIA.

The draft EIA Guidelines recommend that the EIA Review Panel should comprise government personnel whose primary role should include:

- The expeditious review of documents and provision of comments
- Participation in Review Panel Meetings
- Review and comment on various aspects of the EIA; reviewers should limit comments to areas within their expertise or direct concern of their agency
- Advise Chief Town Planner on the quality of the EIA.

EIAs are currently administered by the Town and Country Planning Development Planning Office through an inter-agency mechanism that involves other relevant government agencies. This is not supported by expressed legal authority but occurs because s.17 (1) is currently used as the basis for requesting EIAs. The EMLUP study recommends a consolidation of this process by making amendments to the TCPA. The Minister responsible for Town Planning has oversight of the EIA process.

Climate change considerations are only applied to those applications that are determined under the *Town and Country Planning Act* to require an EIA, and is a formal requirement imposed by the Coastal Zone Management Unit in their capacity as members of the Government EIA Review Committee. Applicants/ developers are asked to address the issues of climate change (mainly sea level rise and storm surge inundation) and outline the adaptation measures they propose to use. The specific issues relating to climate change from a coastal perspective are generally met through the imposition of setback requirements and the establishment of property protection measures. Additionally, in recent times, the risk of water resources being affected by

Integrating Climate Change Adaptation Considerations into the EIA Process

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the EIA process in Barbados.

a) Establishment of Formal EIA Procedures

It is recommended that legislation be enacted to provide certainty and clarity to the EIA process, and to provide a framework for regulating, administering and managing EIAs. Such legislation should allow for the clear identification of the obligations and duties of the proponent and the Chief Town Planner as the government authority responsible for administering the EIA process.

b) Provision of Clear EIA Guidelines for the Preparation of EIA Reports

It is recommended that the draft EIA Guidelines currently being developed by the Town and Country Planning Development Planning Office be adopted and revised as necessary to ensure that the EIA process address climate change impacts. The provision of Model Terms of Reference for addressing climate change adaptation considerations would also assist applicants undertaking an EIA, and ensure consistency in approach.

c) Provision of Clear Criteria for Screening & Scoping Environmental Impacts

It is recommended that the draft EIA Guidelines currently being developed by the Town and Country Planning Development Planning Office provide clear criteria for screening and scoping to ensure identification of the significant climate change impacts on the proposed project or activity. The development of such checklists can assist with the review and evaluation of the EIA report.

d) Provision of Clear Criteria Governing EIA Experts

It is recommended that criteria be established governing the qualification, skills, knowledge and experience which must be possessed by persons conducting EIA. This approach may be used to ensure that persons conducting EIAs and assessing climate change impacts possess the requisite qualification, skills, knowledge and experience on climate change and adaptation policies and measures. The same standard will have to be applied to government experts who review and assess EIAs.

climate change has been addressed with most assessed applicants proposing to: (a) install desalination plants to augment on-site water use; and (b) implement wastewater recovery and water re-use measures to reduce the risk to coastal aquifers from saltwater infusion.

4.2.4 Belize

In Belize the Environmental Impact Assessment (EIA) process is established by the *Environmental Protection Act, Chapter 328* and the EIA Regulations (1995). The *Environmental Protection Act* (EPA) enacted in 1992 was revised in 2000. However, the *Environmental Protection Act* does not define EIA. The Act under s.20 stipulates that any person intending to undertake any project, programme or activity which may significantly affect the environment shall cause an EIA be carried out by a suitably qualified person and submit it to the Department of Environment for evaluation and recommendations.

The EPA requires that the EIA must identify and evaluate the effects of developments on specified components of the environment including:

- Human beings
- Flora and fauna
- Soil
- Water
- Air and climatic factors
- Material assets, including the cultural heritage and the landscape
- Natural resources
- Ecological balance.

It is a requirement of the legislation that EIAs must include mitigation measures which the proponent intends to take to reduce adverse effects on the environment and a statement of reasonable alternative sites. The primary objective of EIAs is to protect and improve human health and living conditions and the need to preserve the reproductive capacity of ecosystems.

Proponents are required by the EPA to consult with public and other interested bodies or organizations when undertaking an EIA. The Department of Environment (DoE) has the discretion under the Act to

prepare its own EIA and to synthesise the views of the public an interested bodies. The DoE is empowered to approve the EIA and must in doing so attach conditions that are reasonably required on environmental grounds.

The EPA empowers the Minister to make regulations prescribing the types of projects, programmes or activities for which an EIA is required. The regulation may also prescribe the procedures, contents, guidelines and other matters relevant to conducting and reviewing EIAs. It is an offence under the EPA for any person to fail to carry out an EIA as required by the Act or related regulations.

The *Environmental Impact Assessment Regulations* (1995) have been made pursuant to s.21 of the EPA and seek to regulate the conducting and review of EIAs in Belize and establish criteria and procedures which should be used to determine whether an activity is likely to have significant effects on the environment.

The EIA Regulations create a general obligation on all persons, agencies and institutions (public or private) unless exempted by the Regulations that before embarking on a proposed project or activity, to apply to the DoE for a determination as to whether an EIA is required. The EIA Regulations prescribe minimum requirements for EIAs that include:

- A description of the proposed activities
- A description of the potentially affected environment
- A description of practical alternatives
- A description of mitigation measures
- An indication of gaps in knowledge and uncertainty which may be encountered in collecting and analyzing the data.

The procedural steps of the EIA process in Belize have been prescribed by Regulation 6 and includes the following three components: (i) a screening of the project by the DoE; (ii) a review of the EIA by the National Environmental Appraisal Committee; and (iii) the design and implementation of a follow up programme. The EIA Regulations provide three possible triggering mechanisms for EIA in Belize:

1. All undertakings, projects and activities listed under Schedule I must have an EIA and the scope and extent of the EIA must be determined by the DoE
2. The DoE has the discretion to request an EIA in respect of undertakings, projects and activities listed under Schedule II
3. Regulation 9 identifies a class of projects and activities that are exempted from the EIA process, such as educational projects, computer processing projects, projects within a Commercial Free Zone, and projects undertaken during national emergencies for which temporary measures have been taken by the Government.

Under Regulation 12 a Proponent may request the DoE to provide EIA guidelines for the preparation of the EIA and the DoE may provide the guidelines for a fee. The Regulations prescribe a time limit within which the DoE must screen applications to determine whether an EIA is required.

The Proponent is required to prepare draft ToRs and submit then to the DoE for the purposes of an EIA. The DoE shall prescribe the contents of the draft ToRs and shall after examining the draft ToRs advise the proponent about their adequacy. The ToRs must be agreed and approved in writing by the DoE before the EIA can commence.

The EIA Regulations mandate the developer to undertake consultation with interested members of the public who fall within or immediately adjacent to the proposed site during the preparation of the EIA. The Regulations stipulate that the purpose of the public consultation is to provide information concerning the proposal and to record the concerns of the local community. In addition the DoE has the discretion at any time during the EIA study to request written submissions from interested person and may forward the comments to the developer.

The EIA Regulations clearly set out the format and contents of the EIA and establishes the procedures for the review of the EIA. The DoE has 60 days within which to communicate its decision on the EIA to the developer. Where an EIA is inadequate the DoE has the discretion, with the recommendation of the National Environmental Appraisal Committee (NEAC), to request the developer to conduct further studies and provide further

information, to amend the EIA accordingly and to resubmit the EIA by a mutually agreed date.

The DoE, on the recommendation of the NEAC, may require a public hearing in respect of any undertaking, project or activity for which an EIA has been requested. In determining whether to request a public hearing the DoE shall give regard to:

- The magnitude and type of environmental impacts, the amount of investment, the nature of the geographical area, and the commitment of natural resources
- The degree of public interest in the proposal
- The complexity of the problem.

There are several actors involved with the EIA process in Belize. The Minister responsible for the Environment has been given specific statutory duties under the EPA and the EIA Regulations. The Minister has been empowered under the EPA to make EIA Regulations and under the EIA Regulations the Minister has the power to appoint a tribunal to hear appeals. The Tribunal reports its finding to the Minister who has the power under the EIA Regulations to allow the appeal, permit the project or dismiss the appeal.

The DoE has the overall responsibility for administering and implementing the EIA procedures and regulations. Regulation 25 of the EIA Regulations establishes the National Environmental Appraisal Committee whose main functions include:

1. reviewing all EIAs
2. advising the DoE of circumstances where a public hearing is desirable or necessary.

The NEAC shall comprise the following members:

- the Chief Environmental Officer
- the Commissioner of Lands
- the Housing and Planning Officer
- the Chief Forest Officer
- the Fisheries Administrator
- the Chief Hydrologist
- the Archaeological Commissioner
- the Director of Geology and Petroleum
- the Chief Agricultural Officer
- two non-governmental representatives.

Regulation 27 (2) of the EIA Regulations empowers the Minister to appoint a Tribunal to hear and determine appeals and report their findings to the Minister.

Integrating Climate Change Adaptation Considerations into the EIA Process

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the EIA process in Belize.:

a) Provision of Clear Criteria for Screening & Scoping Environmental Impacts

It is recommended that the *Environmental Impact Assessment Regulations* (1995) be revised or amended to provide clear criteria in the checklists for screening and scoping to ensure identification of the significant climate change impacts on the proposed project or activity. The development of such checklists can assist with the review and evaluation of the EIA report.

b) Provision of Clear EIA Guidelines for the Preparation of EIA Reports

It is recommended that the *Environmental Impact Assessment Regulations* (1995) be revised or amended to ensure that the EIA process addresses climate change impacts. The provision of Model Terms of Reference for addressing climate change adaptation considerations would also assist applicants undertaking an EIA, and ensure consistency in approach.

c) Provision of Clear Criteria Governing EIA Experts

It is recommended that criteria be established governing the qualification, skills, knowledge and experience which must be possessed by persons conducting EIA. This approach may be used to ensure that persons conducting EIAs and assessing climate change impacts possess the requisite qualification, skills, knowledge and experience on climate change and adaptation policies and measures. The same standard will have to be applied to government experts who review and assess EIAs.

4.2.5 The British Virgin Islands

The present legislation does not specifically refer to EIA's but the Minister for Physical Planning will have the responsibility of making regulations for EIA procedures and conducting EIA statements under the Draft *Planning Act, 2004*. The Minister, will also be empowered to issue a register of those respective individuals that satisfy the prescribed qualifications, skills, knowledge and experience set out in the regulations allowing these individuals to conduct environmental impact statements (EIS) in respect of the territory. Any person who is on the register is deemed by the Act to be approved by the Minister to prepare EIA statements. The *draft development guidelines* outlines specifically which type of project would require EIAs to be developed and implemented, and clearly states what are the requirements that are to be included in the Environmental Impact Statement.

The Development Control Authority, appointed by the Governor in council under the *Land Development (Control) Ordinance, (Cap 241)* is responsible for reviewing all private and public projects of the territory and is given the power to regulate its own procedure.

Applications that are submitted for shoreline alterations and modifications of submerged lands have been required under s.16 of the *Land Development Control Guidelines*, 1972 to submit an EIA. Within the EIA the applicant would be required to submit:

1. A written report of an investigation of the site and adjacent properties about the environmental conditions, ecology, hydrogeology and water mass transports
2. A complete written description of the proposed site including contours, profiles, photographs
3. A complete description of the proposed works which would include supervisory and control procedures
4. A final report that will describe the actual work accomplished and a description of the final

Integrating Climate Change Adaptation Considerations into the EIA Process

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the EIA process in the British Virgin Islands.

a) Revision of Definition of EIA

It is recommended that the definition of EIA under the *Physical Planning Act* be revised to address the impacts of the environment (i.e., climate change) on the project. The following is suggested: *"The process of collection, analysis, evaluation and review of information on:*

i) the likely effects of a proposed development on the environment;

ii) the likely effects of the environment, including climate change effects, on the proposed development; and the means to overcome adverse effects."

b) Provision of Clear Criteria for Screening & Scoping Environmental Impacts

It is recommended that Regulations be promulgated under the *Physical Planning Act* to provide clear criteria in the checklists for screening and scoping to ensure identification of the significant climate change impacts on the proposed project or activity. The development of such checklists can assist with the review and evaluation of the EIA report.

c) Provision of Clear EIA Guidelines for the Preparation of EIA Reports

It is recommended that Regulations be promulgated under the *Physical Planning Act* to provide guidance on the EIA process and ensure that the EIA process addresses climate change impacts. The provision of Model Terms of Reference for addressing climate change adaptation considerations would also assist applicants undertaking an EIA, and ensure consistency in approach.

d) Provision of Clear Criteria Governing EIA Experts

It is recommended that criteria be established governing the qualification, skills, knowledge and experience which must be possessed by persons conducting EIA. This approach may be used to ensure that persons conducting EIAs and assessing climate change impacts possess the requisite qualification, skills, knowledge and experience on climate change and adaptation policies and measures. The same standard will have to be applied to government experts who review and assess EIAs.

site geometry and movement of materials.

The Draft *Planning Act* under s.26 (3) empowers the authority to request EIAs for environmentally sensitive areas and can request that EIS be developed and implemented on projects that the authority deems would cause adverse environmental impact. Although

The Draft *Planning Act* under s.26 (3) clearly states that the Authority shall determine whether environmental impact assessment of the proposal is required depending on:

a) the nature of the development activity

b) the geographical extent, scale and location of the proposed development

c) the extent and significance of the changes to the environment likely to be caused by the proposed development

d) the extent of general knowledge about the nature of the proposed development and its likely impact on the environment

e) any development plan for the area

f) any other matter as may be prescribed.

The Authority under the Draft *Planning Act* 2004 will be prohibited under Section s.27 (4) from granting a development permit unless the EIA is taken into consideration.

Environmental Impact Assessments will be requested for areas deemed sensitive to development such as outlined in the *draft development guidelines,* namely:

1. Large scale residential developments
2. Medium to large commercial projects
3. Mining operations and other manufacturing developments
4. Private energy reserves
5. Developments near any bodies of water
   a) Developments in close proximity to coastlines; and
   b) Developments that may impact watersheds.

The *draft development guidelines* also outline the requirements to conduct EIAs, which would include:

- A detailed description of the proposed development
- Site history; including the current and historical land use
- A description of the potentially affected environment; including characteristics of the marine environment where applicable
- The identification of potential environmental impacts
- An indication of any adjacent property that is likely to be affected by the proposed development or alternatives.
- A description of mitigation alternatives
- Long term monitoring measures
- A Non-technical summary and recommendations.

4.2.6 Cayman Islands

Currently there is no formalised process for incorporating EIAs in the Cayman Islands' development approval process. There is no mandatory requirement under the Development & Planning Law or in the environmental legislation. However, EIAs maybe required by the Central Planning Authority (CPA) [also known as the Planning Board] pursuant to Appendix 3 of the *Development Plan* 1997.

Appendix 3 states that:
"The submission of an environmental impact statement (EIS) for development projects which, because of the characteristics of the site or the particulars of the proposal, may be required in order for the Authority to carefully examine the potential impacts of the development prior to the determination of the application.
An environmental impact statement shall include the appropriate plans, information and data in sufficient detail to enable the Authority to determine, examine and assess the potential environmental impacts of the proposal."

This provision has not been used often, and when it is the Department of Environment (DOE) and the Planning Department review the EIA and make recommendations to the CPA.

DOE is in the process of presenting the *National Conservation Bill*, 2003 which has yet to be tabled/discussed in Parliament. Broadly speaking the Bill seeks to: "…promote and secure biological diversity and the sustainable use of natural resources in the Cayman Islands." The Bill is divided into seven

Integrating Climate Change Adaptation Considerations into the EIA Process

In the absence of a mandatory requirement for EIAs at any level, it is impossible to suggest a process to integrate natural hazard and climate change considerations. The following commentary is a proposal for the establishment of a national EIA process for the Cayman Islands.

a) Revision of EIA Process

It is recommended that the Development And Planning Law (2003 Revision) be amended to make EIAs mandatory because of the nature of a proposal or its location. EIAs should fall within the domain of the Central Planning Authority and not the Department of Environment or any council/authority/commission set up under the proposed legislation. The *decentralisation* of the development review process will only cause confusion and frustration among the various stakeholders.

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the future EIA process in the Cayman Islands.

b) Establishment of Formal EIA Procedures

It is recommended that legislation be enacted to provide certainty and clarity to the EIA process, and to provide a framework for regulating, administering and managing EIAs. Such legislation should allow for the clear identification of the obligations and duties of the proponent and the Director of Planning as the government authority responsible for administering the EIA process.

c) Provision of Clear EIA Guidelines for the Preparation of EIA Reports

It is recommended that the Planning Department and DOE develop EIA Guidelines include provisions for the addressing climate change impacts. The provision of Model Terms of Reference for addressing climate change adaptation considerations would also assist applicants undertaking an EIA, and ensure consistency in approach.

d) Provision of Clear Criteria for Screening & Scoping Environmental Impacts

It is recommended that EIA Guidelines be established to provide clear criteria for screening and scoping to ensure identification of the significant climate change impacts on the proposed project or activity. The development of such checklists can assist with the review and evaluation of the EIA report.

e) Provision of Clear Criteria Governing EIA Experts

It is recommended that criteria be established governing the qualification, skills, knowledge and experience that must be possessed by persons conducting EIAs. This approach may be used to ensure that persons conducting EIAs and assessing climate change impacts possess the requisite qualification, skills, knowledge and experience on climate change and adaptation policies and measures. The same standard will have to be applied to government experts who review and assess EIAs.

parts, forty-three sections and two schedules. Section 36 of the Bill specifies that the *"…Director (DOE) may, in his discretion, require an environmental impact assessment study to be carried out of the proposed decision, undertaking, approval or action."* This section also states what the EIA should assess, who can prepare the EIA, what the fees should be and who pays, what monitoring is required, when a certificate of completion should be issued and an appeal process.

4.3.7 Dominica

The EIA process in Dominica is governed by a new piece of legislation, the *Physical Planning Act*. The main purpose of the Act is to make provision for the orderly and progressive development of land in both urban and rural areas and to preserve and improve the amenities thereof; for the granting of permission to development land and for other powers of control over the use of land; for the regulation of the construction of buildings and related matters; to confer additional powers in respect of the acquisition and development of land for planning purposes and for other matters connected therewith.

The Act defines EIA as:

"The process of collection, analysis, evaluation and review of information on the likely effects of a proposed development on the environment and the means to overcome adverse effects."

Section 23 of the *Physical Planning Act* (PPA) stipulates that unless the Physical Planning and Development Authority (the Authority) otherwise determines, an EIA must be prepared for any application seeking permission for

any of the development prescribed in the Second Schedule of the Act. The Second Schedule lists 18 matters for which an EIA must be prepared.

The Authority has the discretion to request the submission of an EIA where it is of the opinion that significant environmental harm could result. The PPA requires the Authority to screen applications to determine whether an EIA is required. In screening applications for development permission the Authority is required to consider a number of prescribed factors which include:

- The nature of the proposed development
- The geographical extent, scale and location of the proposal
- The extent and significance of changes to the environment
- The extent of general knowledge about the nature of the proposed development and its likely impacts on the environment
- Any development plan for the area.

The Act prescribes a time frame for the EIA process. Once it is determined that an EIA is required the Authority has a specified time limit (30 days) within which to notify the applicant at the same time setting out the ToRs. The PPA requires that the proponent must submit an EIA statement in a form and containing such information as may be prescribed by the Authority.

In the case where the Authority issues a notice for an EIA the PPA is mandated to inform any agency or department of Government having responsibility for the issue of any license, permit, approval consent and any matter affecting the development.

The Act confers power on the Minister to make Regulations prescribing the qualification, skills, knowledge and experience to be possessed by persons preparing EIA statements. The Minister may also cause the creation of a register of persons qualified in preparing EIA

Integrating Climate Change Adaptation Considerations into the EIA Process

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the EIA process in Dominica.

a) Revision of Definition of EIA

It is recommended that the definition of EIA under the *Physical Planning Act* be revised to address the impacts of the environment (i.e., climate change) on the project. The following is suggested: *"The process of collection, analysis, evaluation and review of information on:*

i) the likely effects of a proposed development on the environment;

ii) the likely effects of the environment, including climate change effects, on the proposed development; and the means to overcome adverse effects."

b) Provision of Clear Criteria for Screening & Scoping Environmental Impacts

It is recommended that Regulations be promulgated under the *Physical Planning Act* to provide clear criteria in the checklists for screening and scoping to ensure identification of the significant climate change impacts on the proposed project or activity. The development of such checklists can assist with the review and evaluation of the EIA report.

c) Provision of Clear EIA Guidelines for the Preparation of EIA Reports

It is recommended that Regulations be promulgated under the *Physical Planning Act* to provide guidance on the EIA process and ensure that the EIA process addresses climate change impacts. The provision of Model Terms of Reference for addressing climate change adaptation considerations would also assist applicants undertaking an EIA, and ensure consistency in approach.

d) Provision of Clear Criteria Governing EIA Experts

It is recommended that criteria be established governing the qualification, skills, knowledge and experience which must be possessed by persons conducting EIA. This approach may be used to ensure that persons conducting EIAs and assessing climate change impacts possess the requisite qualification, skills, knowledge and experience on climate change and adaptation policies and measures. The same standard will have to be applied to government experts who review and assess EIAs.

statements. Any person who is listed on the register is deemed by the PPA to be approved to prepare EIA statements in Dominica. Under section 88 of the PPA the Minister is empowered to make Regulations that may provide the procedures for EIA and the form of EIA statements.

The Chief Physical Planner has the discretion to consult in writing with any public officer or with any person who appears to him to be able to provide information relevant to an application for development permission. The Act mandates any Public Authority that is consulted by the Chief Physical Planner for comments to submit those comments within a specified period of time (28 days). The Physical Planning and Development Authority has the discretion to invite any Authority or person consulted for comments to speak at any meeting convened to consider the relevant application.

The Act establishes the Physical Planning and Development Authority (Authority) in s.4 and it is charged with the responsibility of administering and implementing the EIA. The Act converts an existing institution, the Development and Planning Corporation, into the Physical Planning and Development Authority. The main responsibility of the Authority under section 4 (4) is to advance the purposes of the Act. It is the Minister responsible for Physical Planning who has been assigned statutory duties under the PPA in respect of the EIA process.

4.2.8 Grenada

In Grenada the Environmental Impact Assessment process is governed by the *Physical Planning and Development Control Act*, 2002. The purpose of the Act is to make a fresh provision for the control of physical development, to continue the Land Development Authority, to require the preparation of the physical plans for Grenada, to protect the natural and cultural heritage, and for related matters.

The specific objectives of the Act as contained in s. 3 are to:

1. ensure that appropriate and sustainable use is made of all publicly-owned and privately-owned land in Grenada in the public interest
2. maintain and improve the quality of the physical environment in Grenada, including its amenity
3. provide for the orderly subdivision of land and the

Integrating Climate Change Adaptation Considerations into the EIA Process

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the EIA process in Grenada.

b) Provision of Clear Criteria for Screening & Scoping Environmental Impacts

It is recommended that Regulations be promulgated under the *Physical Planning and Development Control Act* (2002) to provide clear criteria in the checklists for screening and scoping to ensure identification of the significant climate change impacts on the proposed project or activity. The development of such checklists can assist with the review and evaluation of the EIA report.

c) Provision of Clear EIA Guidelines for the Preparation of EIA Reports

It is recommended that Regulations be promulgated under the *Physical Planning and Development Control Act* (2002) to provide guidance on the EIA process and ensure that the EIA process addresses climate change impacts. The provision of Model Terms of Reference for addressing climate change adaptation considerations would also assist applicants undertaking an EIA, and ensure consistency in approach.

d) Provision of Clear Criteria Governing EIA Experts

It is recommended that Regulations be promulgated under the *Physical Planning and Development Control Act* (2002) to establish criteria governing the qualification, skills, knowledge and experience which must be possessed by persons conducting EIA. This approach may be used to ensure that persons conducting EIAs and assessing climate change impacts possess the requisite qualification, skills, knowledge and experience on climate change and adaptation policies and measures. The same standard will have to be applied to government experts who review and assess EIAs.

provision of infrastructure and services in relation thereto

4. maintain and improve the standard of building construction so as to secure human health and safety
5. protect and conserve the natural and cultural heritage.

Section 25 of the Act makes provision for EIAs in Grenada. Under this section the Planning and Development Authority has the power to, in addition to requesting further information, require an EIA to be carried out in respect of any application for permission to develop land. This includes an application for approval in principle.

The Second Schedule of the Act contains a list of activities which requires an EIA unless the Land Development Authority, for good cause, determines otherwise. Before the Land Development Authority can grant permission, the Act mandates that the EIA report must be taken into account.

The Minister responsible for planning and development is empowered by s. 25 (4) to make regulations providing for:

a) criteria and procedures for determining whether a development is likely to significantly affect the environment
b) the procedures for setting the scope of the EIA
c) the minimum contents of an EIA report
d) the qualifications, skills, knowledge or experience which must be possessed by persons conducting EIAs
e) the procedures for public participation in the EIA process and public scrutiny of any EIA report
f) the consideration by the Land Development Authority of an application in respect of which an EIA is required, including the criteria and procedures for review of the report.

Under the Act, if the Authority notifies an applicant that an EIA is required, the Physical Planning Unit and any other public agency must, if requested by the applicant, enter into consultation with the applicant to determine whether that agency has in its possession any information which the applicant considers to be relevant. The Act prohibits any agency or department of government from issuing any licence, permit, approval, consent or other document of authorization in connection with an application that requires an EIA unless the Land Development Authority gives notice.

The institution with lead responsibility for EIA procedures in Grenada under the *Physical Planning and Development Control Act* (2002) is the Planning and Development Authority. The Planning and Development Authority is a creature of statute and according to s.6 of the Act comprises the following members:

a. A chairperson
b. Three persons from the private sector representing the areas of business, finance, law, natural science, land surveying, architecture and engineering
c. The Chief Technical Officers responsible for: (i) physical planning (ii) public works (iii) health services (iv) agriculture (v) housing (vi) water and sewage.

The Planning and Development Authority is the agency empowered under the law to request applicants to submit EIAs. This is done through the issuing of EIA notices to the applicant. At the same time that an EIA notice is issued to the applicant the Planning and Development Authority must inform agencies and departments of government which have responsibility for issuing licences, permits, approvals, and consents for matters connected to the proposed project. The Planning and Development Authority is prohibited from granting permission for the development of land for which an EIA has been requested unless it has first taken into account the EIA report.

The Minister with responsibility for planning and development has the discretion under the Act to make EIA regulations. The Physical Planning Unit, and any other public agency with relevant information, have a statutory duty under the Act to enter into consultation with the applicant and to make relevant information available to the applicant.

4.2.9 Guyana

The Environmental Impact Assessment (EIA) process in Guyana is based on a formal legal framework. The legislation that governs the EIA process in Guyana is the *Environmental Protection Act* (EP Act). The *Environmental Impact Assessment Guidelines 2000 (Vol 1) Rules and Procedures* supplement this legislation and were jointly prepared by the Environmental Protection Agency (EPA) and the Environmental Assessment Board (EAB).

The *Environmental Protection Act* (EP Act) was enacted in 1996 and has since been amended in 2000. Further amendments are to be made to the EP Act, which are awaiting the Attorney General's approval before submission to Parliament. The main purpose of the EPA Act is to provide for the management, conservation, protection and improvement of the environment, the prevention or control of pollution, the assessment of the impact of economic development, the sustainable use of natural resources and for matters incidental thereto or connected therewith.

This Act is divided into 10 parts:

1. Preliminary Section
2. Establishment and Functions of Agency
3. Administration
4. Environmental Impact Assessments
5. Prevention and Control of Pollution
6. Financial Assurance
7. Investigations, Prosecutions, Civil Proceedings
8. Establishment and Jurisdiction of Environmental Appeals Tribunal
9. Environmental Trust Fund and Finances
10. Miscellaneous.

The EPA Act establishes the requirement for Environmental Impact Assessments in Guyana. Part IV contains provisions regulating EIAs. Under this Part, s. 11 any developer whose project falls within the classes of projects listed in the Fourth Schedule or any other project that may significantly affect the environment is required to apply to the Environmental Protection Agency (referred to as "Agency") for an Environmental Permit. Section 10 of the EPA Act defines EIA as an assessment as provided for under Part IV of the Act.

There is a prescribed form that an applicant seeking an environmental authorisation must submit to the Agency for any new developmental works. This form requires the applicant to submit information on:

- the site, design and size of the project

Integrating Climate Change Adaptation Considerations into the EIA Process

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the EIA process in Guyana.

a) Revision of Definition of EIA

It is recommended that the definition of EIA under the *Environmental Protection Act* (EPA) No.11 of 1996 and *Environmental Impact Assessment Guidelines* 2000 be revised to also address the impacts of the environment (i.e., climate change) on the project.

b) Provision of Clear Criteria for Screening & Scoping Environmental Impacts

It is recommended that procedures established under the *Environmental Protection Act* (EPA) No.11 of 1996 and *Environmental Impact Assessment Guidelines* 2000 provide clear criteria for screening and scoping to ensure identification of significant climate change impacts on the proposed project or activity. The development of such checklists can assist with the review and evaluation of the EIA report.

c) Provision of Clear EIA Guidelines for the Preparation of EIA Reports

It is recommended that procedures established under the *Environmental Protection Act* (EPA) No.11 of 1996 and *Environmental Impact Assessment Guidelines* 2000 ensure that the EIA process addresses climate change impacts. The provision of Model Terms of Reference for addressing climate change adaptation considerations would also assist applicants undertaking an EIA, and ensure consistency in approach.

d) Provision of Clear Criteria Governing EIA Experts

It is recommended that the criteria established under *Environmental Protection Act* (EPA) No.11 of 1996 governing the qualification, skills, knowledge and experience which must be possessed by persons conducting EIAs be reviewed to ensure to ensure that persons conducting EIAs and assessing climate change impacts possess the requisite qualification, skills, knowledge and experience on climate change and adaptation policies and measures. The same standard will have to be applied to government experts who review and assess EIAs.

- possible effects on the environment
- the duration of the project
- a non-technical explanation of the project.

Once an application is submitted to the Agency for an environmental authorisation, the EPA determines whether an EIA is required for the project or not. In all cases the developer submits a project summary or an outline of the proposed project for EPA screening. The general practice is to ask for a detailed project summary only in cases where an EIA is to be undertaken.

In the case where it is not clear whether a project will significantly affect the environment the developer must submit a summary of the project to the Agency containing the same information as in the case of an application for an Environmental Permit. For this class of project the Agency decides whether to exempt the project from having to undertake an EIA or it may require an EIA, and it must place a public notice in a local daily newspaper.

Where the Agency exempts a project than under s.11 (3) any person who may be affected by that project has the right of appeal against the decision of the Agency. The legislation prescribes the procedures for the appeal which must be made to Environmental Assessment Board.

The EP Act stipulates that only an independent and suitably qualified person approved by the Agency can carry out an EIA[3]. The legislation establishes the procedures for undertaking EIAs and the contents of the EIA report (statement). Section 11 (4) specifies what persons conducting EIAs must consider and s.11 (5) details what EIAs must contain.

Persons undertaking EIAs are required to identify, describe and evaluate the direct and indirect effects of the proposed project on the environment. The legislation lists those environmental receptors that must be assessed such as human beings; flora and fauna and species habitat; water soil; air and climatic factors; material assets, the cultural heritage and the landscape; natural resources; and the ecological balance between ecosystems.

Under s 11(5) every EIA must contain:

- a description of the project (location, production processes, emissions, etc.)
- an outline of the main alternatives
- a description of likely significant effects
- an indication of difficulties (technical, expertise, knowledge, etc.) encountered during the study
- description of best available technology
- description of any hazards or dangers which may arise from the project and an assessment of the risk to the environment
- description of mitigation measures
- a statement of the degree of irreversible damage
- an emergency response plan
- a rehabilitation and restoration programme
- a non-technical summary of the information.

In all cases the Agency publishes in a daily news paper the decision of the Agency as to whether an EIA is required for the project or not. In the case of a project requiring an EIA, then the notice is published at the developer's cost. If an EIA is not required, the public has a 60-day public notification period to make objections to the EPA against its decisions. Should an EIA be required, then the public has a 28-day public notification period to make written submissions for considerations in the EIA. There is no qualification in the legislation indicating which members of the public have a right to make submissions. Even though it is not in the legislation, EPA takes submissions from all stakeholders who have a vested interest in the project.

The Agency, in consultation with the EIA consultant and after holding scoping meetings, sets the Terms of Reference (TORs) and scope of the EIA. In all cases, the Agency considers submissions that have been made by the public when determining the TORs. This process is further elaborated in the *Environmental Impact Assessment Guidelines 2000 (Vol. 1) Rules and Procedures*.

The EP Act under s. 12 authorizes the Agency to approve or refuse the project after considering a number of factors including public submissions, the recommend-ations of the Environmental

[3] This can be contrasted with the Dominica Physical Planning Act which authorizes the Minister to make Regulations in respect of the qualifications of persons preparing EIA Reports as opposed to conducting EIAs.

Assessment Board and the EIA and Environmental Impact Statement (EIS). The Act requires the Agency to publish its decision and the grounds for making that decision.

Under s. 13 the Agency stipulates that a decision by the Agency to grant an environmental permit shall be subject to a number of statutory conditions. The Agency has a statutory duty not to issue an environmental permit unless it is satisfied that the developer can comply with the terms and conditions of the permit and that the developer can pay compensation for any loss or damage which may arise from the project or a breach of any of the terms and conditions of the permit.

The environmental permit takes precedence over other development consents. The EP Act (s. 14) prohibits other public agencies responsible for issuing development consents in relation to matters where an environmental authorization is needed, from so doing unless such an environmental permit has been issued. The Act provides that any development consent given is subject to the terms of the environmental authorisation.

It is an offence under the EP Act where any person fails to carry out an EIA or starts a project without obtaining an environmental permit as required by the law. Under s 16 of the EP Act the Minister is empowered to make Regulations establishing criteria and thresholds to determine which projects may have significant effects on the environment. The Agency has not yet established any criteria to determine which projects would have significant effects on the environment.

The EPA also regulates other activities which on their own may not have a significant effect on the environment. In this case, those activities that, because of their location in a particular place, will have cumulative effects that significantly affect the environment the Agency, must request the submission of an EIA.

The *Environmental Impact Assessment Guidelines 2000 (Vol 1): Rules and Procedures for Conducting and Reviewing EIAs* is a manual jointly prepared by the Environmental Protection Agency and the Environmental Assessment Board. The purpose of these guidelines is to provide the Environmental Protection Agency (EAB), sector agencies, private sector, NGOs, members of the public and consultants with a set of approved guidelines for the conduct and review of EIAs in Guyana.

The EIA guidelines operate in harmony with Part IV of the EP Act and represent the first volume in a series of volumes dealing with specific matters, such as:

- Generic EIA guidelines (Vol. 2)
- Sector Specific EIA Guidelines, for example Mining (Vol. 3); Electricity (Vol. 4); and Forestry (Vol. 5).

The EIA guidelines for conducting and reviewing EIAs sets out the processes involved in undertaking and reviewing EIAs. It clearly describes the role of the various actors in the process. The EIA guidelines define the various components of the EIA. The EIA process in Guyana consists of three components:

1. The Environmental Baseline Study
2. Environmental Assessment
3. Environmental Impact Statement.

The EIA may be submitted to the Agency in its constituent components or as a single document. The baseline study provides information on the state of the environment within the sphere of influence of the project before the project is implemented. This information forms the input to the environmental assessment where it is analysed to predict and quantify likely impacts.

The Environmental Assessment is a process that involves the identification and assessment of impacts of the proposed project and its alternatives. Consideration is also given to mitigation measures to prevent or reduce negative impacts.

The Environmental Impact Statement is a summary of the findings of the other two components: the baseline study and the environmental assessment. It includes an Environmental Management Plan.

The EIA guidelines set out the rules and procedures of the EAB. The guidelines contain an EIA Review Checklist. The checklist is in a matrix format which lists the elements to be evaluated with provision for comments/ recommendations and rating.

The Environmental Protection Agency is the main body responsible for the administration and implementation of the *Environmental Protection Act*. Part II

of the Act provides for the establishment of the Agency and identifies its functions which include, *inter alia*:

"To ensure that any development activity which may cause an adverse effect on the natural environment be assessed before such activity is commenced, and that such adverse effect be taken into account in deciding whether or not such activity should be authorized".

The EP Act establishes an Environmental Assessment Board (EAB) with responsibility for conducting public hearings into EIA appeals; and as may be necessary in any EIA and EIS, to recommend to the Agency:

- whether the EIA or EIS should be accepted, amended or rejected
- whether an environmental permit should be issued by the Agency
- what terms and conditions should be included in the environmental permit.

One of the main functions of the EAB is to ensure a participatory and consultative approach to EIA development by facilitating the participation of the public and regulatory agencies in the EIA process, especially as it relates to the preparation and review of the scope of work and ToRs. The legislation is silent on which Minister has responsibility for the EIA process. Currently there is no Minister with responsibilities for environment, however, the President acts as the Minister.

4.2.10 Jamaica

The Environmental Impact Assessment process in Jamaica is governed by the *Natural Resources Conservation Authority Act, 1991* (NRCA), the *Natural Resources Conservation (Permits and Licences) Regulations, 1996* and the *Natural Resources Conservation Authority Guidelines for Conducting Environmental Impact Assessments, 1998.*

Under s.10 of the NRCA the Natural Resources Conservation Authority (referred to as the "Authority") is empowered to request an applicant for a permit – or the person responsible for undertaking a specified class of

Integrating Climate Change Adaptation Considerations into the EIA Process

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the EIA process in Jamaica.

a) Revision of Definition of EIA

It is recommended that the definition of EIA under the *Natural Resources Conservation Authority Guidelines for Conducting Environmental Impact Assessments, 1998* be revised to also address the impacts of the environment (i.e., climate change) on the project.

b) Provision of Clear Criteria for Screening & Scoping Environmental Impacts

It is recommended that procedures established under the *Natural Resources Conservation Authority Guidelines for Conducting Environmental Impact Assessments, 1998* provide clear criteria for screening and scoping to ensure identification of significant climate change impacts on the proposed project or activity. The development of such checklists can assist with the review and evaluation of the EIA report.

c) Provision of Clear EIA Guidelines for the Preparation of EIA Reports

It is recommended that procedures established under the *Natural Resources Conservation Authority Guidelines for Conducting Environmental Impact Assessments, 1998* ensure that the EIA process addresses climate change impacts. The provision of Model Terms of Reference for addressing climate change adaptation considerations would also assist applicants undertaking an EIA, and ensure consistency in approach.

d) Provision of Clear Criteria Governing EIA Experts

It is recommended that criteria be established under the *Natural Resources Conservation Authority Guidelines for Conducting Environmental Impact Assessments, 1998* governing the qualification, skills, knowledge and experience which must be possessed by persons conducting EIAs be reviewed to ensure to ensure that persons conducting EIAs and assessing climate change impacts possess the requisite qualification, skills, knowledge and experience on climate change and adaptation policies and measures. The same standard will have to be applied to government experts who review and assess EIAs.

development, construction or any enterprise in a prescribed area – to submit to the Authority an EIA containing prescribed information. The Authority may also require an applicant to furnish it with such documents or information which the Authority thinks fit.

There is no expressed definition of EIA in the NRCA, however the EIA Guidelines define EIA as:
"A study of the effects of a proposed action on the environment."

The Authority can request an EIA where it is of the opinion that the activities of the enterprise, construction or development are having, or are likely to have an adverse effect on the environment. The Act compels the applicant to comply with the requirement. The request for an EIA must be by notice in writing to the applicant. The legislation provides that the notice must state the time within which the assessment shall be submitted to the Authority.

Once the Authority issues a notice requesting an EIA the NRCA mandates the Authority to inform any agency or department of Government having responsibility for the issue of any licence, permit, approval or consent in connection with any matter affecting the environment that a notice has been issued. The Act prohibits such agency or department having been notified from granting the licence, permit, approval or consent. It is an offence under the Act where any person who is not an applicant for a permit refuses or fails to submit an EIA as required by the Authority.

Section 38 (1) (b) of the NRCA gives the Minister the discretion to make regulations that may contain provisions in relation to the description or category of enterprise, construction or development in respect of which an environmental impact assessment is required by the Authority. The Act binds the Crown.

Under regulation 18, of the *Natural Resources of Conservation (Permits and Licences) Regulations*, the Authority may, upon the evaluation of an application for a permit or licence, require the applicant to furnish any document, information or environmental impact assessment pursuant to section 10 of the NRCA.

There are no EIA regulations in Jamaica but under the Permit and Licence system of 1997, permits and licences are required in a prescribed area and for prescribed categories of activities.

The *Natural Resources Conservation Authority Guidelines for Conducting Environmental Impact Assessments*, 1998 describe the steps and procedures for conducting and reviewing EIAs in Jamaica. The EIA process in Jamaica involves:

- Preliminary activities including scooping or setting terms of reference for the EIA, selecting the consultant to do the EIA, and review of existing legislation
- Submission of draft ToR to the Authority for approval
- Conducting the EIA study
- Collecting background data and information
- Public involvement
- Identification of impacts in terms of magnitude and significance
- Socio-economic analysis of project effects/impact
- Recommending mitigation action for each impact identified
- Analysis of alternatives of the project (economic and environmental)
- Training requirements of the project
- Development of a monitoring programme/plan
- Documenting the study in the EIA report.

Annex 2 of the EIA Guidelines provides a description or category of enterprise, construction or development which require an EIA in accordance with s. 38 (1) (b) of the NRCA. Annex 3 provides a basic checklist which can be used to compile the description of the environmental setting. These include:

1. Basic land conditions including the geological conditions, soil conditions and archaeological value of site
2. Biotic community conditions which includes plant and animal
3. Watershed conditions
4. Atmospheric conditions.

Section 3 Part I of the NRCA, which establishes the Natural Resources Conservation Authority, (referred to as the "Authority"), provides that the Authority is responsible for the administration and implementation of the EIA process.

4.2.11 St. Kitts and Nevis

The environmental impact assessment process in St. Kitts and Nevis is regulated under the *Development Control and Planning Act* (2000). Part IV, section 26 and Schedule 3 of the Act identifies categories of proposals that require an EIA. Categories of projects that require a mandatory EIA include:

- Hotels of more than 12 rooms, and residential sub-divisions of more than 6 plots/units
- Industrial plants, hyrdo-electric and diesel power plants
- Quarrying and mining activities, land reclamation, dredging, dams/reservoirs; filling ponds
- Airports, marinas, ports and harbours
- Gas pipelines and projects resulting in significant emissions into the environment
- Solid waste operations and sanitary landfills
- Activities involving the discharge of radio-active materials
- Development in environmentally sensitive area (wetlands, marine parks, etc.).

The Physical Planning Division (PPD) is responsible for receiving applications and undertaking preliminary screening exercises. The PPD is the Secretariat of the Development Control and Planning Board (DCPB), which is the lead agency for EIAs and is responsible for final review and approval of the EIA, taking into consideration recommendations of the PPD.

Although there are no formal guidelines to assist in the EIA process, the Physical Planning Division (PPD) provides guidance on a case-by-case basis. A draft outline of EIA report requirements is provided to applicants. However, the final Terms of Reference for the EIA report is based on the results of project screening and scoping. Review criteria and methods for assessing the EIA report have not been established.

Public participation in the EIA process is encouraged through a process of public notices in local newspapers. No mechanism has been established that guarantees public access to the EIA report.

Integrating Climate Change Adaptation Considerations into the EIA Process

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the EIA process in St. Kitts and Nevis.

a) Provision of Clear Criteria for Screening & Scoping Environmental Impacts

It is recommended that Regulations be promulgated under the *Development Control and Planning Act* (2000) to provide clear criteria in the checklists for screening and scoping to ensure identification of significant climate change impacts on the proposed project or activity. The development of such checklists can assist with the review and evaluation of the EIA report.

b) Provision of Clear EIA Guidelines for the Preparation of EIA Reports

It is recommended that Regulations be promulgated under the *Development Control and Planning Act* (2000) to provide guidance on the EIA process and ensure that the EIA process addresses climate change impacts. The provision of Model Terms of Reference for addressing climate change adaptation considerations would also assist applicants undertaking an EIA, and ensure consistency in approach.

c) Provision of Clear Criteria Governing EIA Experts

It is recommended that Regulations be promulgated under the *Development Control and Planning Act* (2000) to establish criteria governing the qualification, skills, knowledge and experience which must be possessed by persons conducting EIAs. This approach may be used to ensure that persons conducting EIAs and assessing climate change impacts possess the requisite qualification, skills, knowledge and experience on climate change and adaptation policies and measures. The same standard will have to be applied to government experts who review and assess EIAs.

4.2.12 St. Lucia

In St. Lucia the EIA system is governed by the proposed *Physical Planning and Development Control Act* (No. 29 of 2001). Under s. 22 of the Act the Head of the Physical Planning and

Development Division has the power to request an applicant for planning permission to prepare an EIA. This includes an application for approval in principle. The Fourth Schedule of the Act identifies those activities which will normally require an EIA unless the Head of the Physical Planning and Development Division determines otherwise.

The Minister responsible for planning and development is given the discretion under the Act to make EIA regulations, in consultation with the Head of the Physical Planning and Development Division. The Act prescribes that the regulations must provide for the following:

a. The criteria and procedures for determining whether an activity is likely to significantly affect the environment
b. The procedures for setting the scope of works of the EIA to be carried out by the applicant
c. The minimum contents of the Environmental Impact Statement
d. The qualifications, skills, knowledge or experience which must be possessed by persons conducting EIAs
e. The procedures for public participation in the EIA process and public scrutiny of the Environmental Impact Statement
f.. The consideration by the Head of the Physical Planning and Development Division of an application in respect of which an EIA has been required, including the criteria and procedures for review of the Environmental Impact Statement.

Integrating Climate Change Adaptation Considerations into the EIA Process

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the EIA process in St. Lucia.

a) Provision of Clear Criteria for Screening & Scoping Environmental Impacts

It is recommended that Regulations be promulgated under the *Physical Planning and Development Control Act* to provide clear criteria in the checklists for screening and scoping to ensure identification of significant climate change impacts on the proposed project or activity. The development of such checklists can assist with the review and evaluation of the EIA report.

b) Provision of Clear EIA Guidelines for the Preparation of EIA Reports

It is recommended that Regulations be promulgated under the *Physical Planning and Development Control Act* to provide guidance on the EIA process and ensure that the EIA process addresses climate change impacts. The provision of Model Terms of Reference for addressing climate change adaptation considerations would also assist applicants undertaking an EIA, and ensure consistency in approach.

c) Provision of Clear Criteria Governing EIA Experts

It is recommended that Regulations be promulgated under the *Physical Planning and Development Control Act* to establish criteria governing the qualification, skills, knowledge and experience which must be possessed by persons conducting EIAs. This approach may be used to ensure that persons conducting EIAs and assessing climate change impacts possess the requisite qualification, skills, knowledge and experience on climate change and adaptation policies and measures. The same standard will have to be applied to government experts who review and assess EIAs.

Under the Act, if the Head of the Physical Planning and Development Division notifies the applicant that an EIA must be provided, the Minister and any other public agency in possession of relevant information is required to enter into consultation with the applicant and to provide such information to the applicant. In addition, once an EIA notice is given to an applicant the Head of the Physical Planning and Development Division must inform any agency or department of Government having responsibility for the issue of any licence, permit, approval, consent or other document of authorization in connection with the proposed project, and the agency or department of government is prohibited from granting such licence, permit, approval, consent or other document of authorization unless it has been duly notified by the Head of the Physical Planning and Development Control Division.

The Head of the Physical Planning and Development Control Division will have the lead responsibility for the EIA process in St. Lucia in accordance with the proposed *Physical Planning and Development Act*. The Head of the Physical Planning and Development Division has been assigned specific functions in respect of the EIA system that include the following:

- The screening of applications in accordance with s. 22 (2) to determine whether the proposal falls within the list of activities listed in the Fourth Schedule
- Requesting an applicant to submit an EIA
- Informing relevant Government agencies and departments of the EIA notice.

The Minister responsible for planning and development has been empowered by the Act, in consultation with the Head of the Physical Planning and Development Division, to make EIA regulations. Under s. 22 (5) of the Act the Minister is mandated to consult with and share relevant information in his possession with the applicant for the preparation of an EIA.

4.2.13 St. Vincent and the Grenadines

Generally, there is no legal basis for EIAs in St. Vincent and the Grenadines, and such evaluations are undertaken on a case-by-case basis. However, under the *Waste Management Act* (No. 31 of 2000), section 11 requires an environmental impact assessment to be undertaken for all waste management facilities. Part IV of the Act establishes the EIA process for any waste management facility. The initial step in the process is an application for a "pre-evaluation" that must be submitted to the Physical Planning and Development Board (termed the "planning authority") established under the *Town and Country Planning Act* (1992). Within 10 working days of receiving any application, the planning authority undertakes a screening to determine whether an EIA is required. The planning authority will advise the applicant that:

Integrating Climate Change Adaptation Considerations into the EIA Process

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the EIA process in St. Vincent and the Grenadines.

a) Establishment of Formal EIA Procedures

In order to address activities outside the scope of the EIA process outlined in the *Waste Management Act*, it is recommended that legislation be enacted to provide certainty and clarity to the EIA process, and to provide a framework for regulating, administering and managing EIAs. Such legislation should allow for the clear identification of the obligations and duties of the proponent and the Physical Planning and Development Board as the government agency responsible for administering the EIA process.

b) Provision of Clear Criteria for Screening & Scoping Environmental Impacts

It is recommended that an EIA Manual be developed to provide clear criteria and checklists for screening and scoping to ensure identification of significant climate change impacts on the proposed project or activity. The development of such checklists can assist with the review and evaluation of the EIA report.

c) Provision of Clear EIA Guidelines for the Preparation of EIA Reports

It is recommended that an EIA Guide be prepared to assist developers and EIA practitioners in undertaking the EIA process. Such a Guide should ensure that the EIA process addresses climate change impacts. The provision of Model Terms of Reference for addressing climate change adaptation considerations would also assist applicants undertaking an EIA, and ensure consistency in approach.

d) Provision of Clear Criteria Governing EIA Experts

It is recommended that criteria be established governing the qualification, skills, knowledge and experience which must be possessed by persons conducting EIAs. This approach may be used to ensure that persons conducting EIAs and assessing climate change impacts possess the requisite qualification, skills, knowledge and experience on climate change and adaptation policies and measures. The same standard will have to be applied to government experts who review and assess EIAs.

a) a comprehensive environmental impact assessment is required;

b) a "focus report" is required; or

c) no further in formation is required and the project will be recommended to cabinet for approval.

Where either an EIA or a focus report is required, the planning authority shall provide the applicant with Terms of Reference for the evaluation that is to be undertaken. Thereafter, the applicant shall undertake, at his/her own expense, a study and report that complies with the requirements of the Terms of Reference. Section 13 of the *Waste Management Act* outlines the scope of any environmental impact assessment report that shall be submitted for consideration, including:

a) Description of the proposed activity, and any technically feasible alternatives

b) Description of the environmental setting

c) Description of the social and environmental impacts that may result during construction, operation, decommissioning or abandonment

d) Description of the residual adverse environmental and social impacts

e) An environmental protection plan

f) A waste management plan outlining waste reduction programs, monitoring and surveillance programs, mitigation measures.

The planning authority may require the applicant to provide any additional information that may be required. Section 15 of the *Waste Management Act* requires the planning authority to render a decision on the EIA report.

It shall be the responsibility of the applicant under the provisions of section 16 of the *Waste Management Act* to implement any monitoring program, environmental protection plan, or mitigation measure that constitutes a condition of any approval granted by the planning authority. The planning authority is permitted to undertake inspections at any stage and issue an order to stop work in the event of non-compliance with any condition. A fine of one hundred and twenty thousand dollars may be imposed on any person who: (i) contravenes any condition of an approval; (ii) carries out any construction activities before an approval is granted; or (iii) contravenes any order to stop work. Section 17 of the *Waste Management Act* empowers the planning authority to issue guidelines to regulate various aspects of the EIA process.

In instances other than those regulated under the *Waste Management Act*, EIAs are conducted on a case-by-case basis, with little by way of guidance to the applicants or organisations involved in the process. Persons or organisations undertaking an EIA use their own discretion as to whether the public shall participate in the process. An EIA that has been submitted to the planning authority is generally made available to the public.

4.2.14 Trinidad and Tobago

The environmental impact assessment process in Trinidad and Tobago forms part of the "Certificate of Environmental Clearance (CEC)" system that has been established under section 35 of the *Environmental Management Act 2000*.

Enacted in 1994, the *Environmental Management Act* provides for the management of the environment within Trinidad and Tobago through the establishment and operation of the Environmental Management Authority (EMA). This Act was subsequently repealed and replaced in 2000. There were no significant differences in the new Act. The Act, set out in nine parts, establishes the Environmental Management Authority (EMA) in Part II, invests the Authority with functions and powers in Part III, and deals with environmental management matters in parts IV, V and VI.

Section 26 of the *Environmental Management Act* empowers the Environmental Management Authority to make rules for the purpose of giving effect to the requirements of the Act. Acting under this provision, and to give effect to some of the goals and objectives of the *National Environmental Policy*, the Environmental Management Authority has developed and promulgated the *Certificate of Environmental Clearance Rules 2001*. These Rules outline the process and procedures to be applied in any application for a Certificate of Environmental Clearance under section 36 of the Act.

The objective of the Certificate of Environmental Clearance is the

Integrating Climate Change Adaptation Considerations into the CEC/EIA Process

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the CEC/EIA process in Trinidad and Tobago.

a) Provision of Clear Criteria for Screening & Scoping Environmental Impacts

It is recommended that the *CEC Review Manual* be amended to provide clear criteria in the checklists for screening and scoping to ensure identification of significant climate change impacts on the proposed project or activity. The development of such checklists can assist with the review and evaluation of the EIA report.

b) Provision of Clear EIA Guidelines for the Preparation of EIA Reports

It is recommended that the Guide for the Application for a Certificate of Environmental Clearance be modified to ensure that the EIA process addresses climate change impacts. The provision of Model Terms of Reference for addressing climate change adaptation considerations would also assist applicants undertaking an EIA as part of the CEC process, and ensure consistency in approach.

c) Provision of Clear Criteria Governing EIA Experts

It is recommended that criteria be established governing the qualification, skills, knowledge and experience which must be possessed by persons conducting EIA. This approach may be used to ensure that persons conducting EIAs and assessing climate change impacts possess the requisite qualification, skills, knowledge and experience on climate change and adaptation policies and measures. The same standard will have to be applied to government experts who review and assess EIAs.

attainment of integrated environmental management on a national level. To achieve this objective, proposed activities need to be assessed to consider likely impacts, environmental risks, as well as mitigation and monitoring for potential adverse effects. The Certificate of Environmental Clearance is a certificate that may or may not be granted for a particular activity. If the Certificate of Environmental Clearance is granted, this certifies the environmental acceptability of the proposed activity, provided that all conditions contained in the CEC are fulfilled.

EIA is part of the CEC process and is undertaken to identify and evaluate specific environmental concerns of a proposed activity. Not all applications for a CEC will require an EIA. There is a charge for processing a CEC application that requires an EIA. This charge may vary from TT$5,000 up to TT$600,000 depending upon the activity and complexity of the EIA evaluation. CEC applications that require an EIA are given special mention in the *Certificate of Environmental Clearance Rules 2001* with respect to public consultation.

The *Environmental Management Act* has, by means of an attached Schedule to the CEC Order, outlined a designated list of activities that require Certificate of Environmental Clearance. These activities are considered to have the potential for significant adverse effects or risks to the environment, whether in the phase of establishment, expansion, operation, decommissioning or abandonment. Designated activities are listed in the following broad categories:

- Agriculture
- Heavy and Light Manufacturing Industry
- Civil Works
- Natural Resource/Mineral Extraction and Processing
- Waste Disposal
- Transport Operations and Construction of Associated Infrastructure
- Other Service-Oriented Industries.

The key steps in the process are as follows:

Step 1 - Submission of Application (including project description)

Step 2 - Screening and Acknowledgement (within 10 working days of receipt of Application)

Step 3 - Determination whether:
- CEC is not required,
- CEC is required but no EIA,
- CEC and EIA required

IF CEC and EIA required:

Step 4 - Applicant Notified of Proposed Terms of Reference for the EIA (within 21 working days of notification that CEC and EIA required)

Step 5 - Either Terms of Reference are Agreed, or the Applicant may Request a Modification to the Terms of Reference

Step 6 - Final Terms of Reference Issued (within 10 working days of request for modification)

Step 7 - Submission of EIA Report by Applicant

Step 8 - Notification of Decision (within 10 working days of receipt of EIA report).

The Environmental Management Authority (EMA) has prepared a Guide (*CEC Review Manual*) for the review of environmental impact assessment (EIA) reports. The Guide has been developed to ensure consistency in the EIA review process. The Guide provides checklists for Screening and Scoping, the evaluation of "alternatives," and to assist in the review process.

SECTION 5 Integration of Climate Change Considerations into EIA's at the National Level – South Pacific

5.0 Background

Environmental Impact Assessment (EIA) is one of the many tools available to ensure that development results in minimal environmental and resource damages, reducing threats to the carrying capacity of island systems (ecological, social and economic). EIA is considered an important element to achieve sustainable development in the Pacific and several countries have instituted EIA legislation or policy processes to reflect this (see *Figure 28*). Given that the insular Pacific is small, and its human and natural environments are highly vulnerable to anthropogenic stresses and climate-related hazards, Pacific Island Countries (PICs) have been proactive at many international negotiation forums in calling for the integration of environmental considerations in the development assessment process, including the need for integrated planning. The recent Pacific submission to the Johannesburg Plan of Implementation (JPoI) for the World Summit on Sustainable Development (WSSD) contains a number of actions that have particular relevance to the furthering of EIA and integrated environmental planning in PICs.

Although climate-related disasters are one of the major issues threatening the very existence of Pacific people, the EIA process of most PICs do not specifically consider climate or climate change as a separate issue for any detailed assessment, but amalgamates it into the broader biophysical issues in the scoping stages of EIA. For some PICs, climate may be considered under the various headings of coastal hazard zones, coastal flood zones, coastal erosion or in areas of possible landslides. Certain countries do mention climatic factors in the Environmental Significance Declaration (ESD) form, which is used as a guideline (Terms of Reference) for preparing EIAs but not specifically climate change.

A South Pacific Regional Environment Programme (SPREP) review of the EIA status in the Pacific conducted in 1998[1] and updated in 2002[2], reported that all PICs give EIA a high priority in terms of environmental protection as well as providing the initial tool for integrated assessment. The focus of the prior reviews was to report on the operational status of EIA and barriers to its effective use in-country, especially for integrating development assessment processes. Perceptions of what EIA is have varied over time. In both developed and developing countries, prior definitions were along the lines of EIA being "a public process of prediction and evaluation of the likely effects that an activity will have on the environment, before that activity starts."[3] This definition limits the focus of EIA into primarily determining how projects

[1] Komeri Ontario 1998. Environmental Impact Assessment Review. South Pacific Regional Environment Programme, unpublished.

[2] Matt McIntyre 2002. EIA Review Update. South Pacific Regional Environment Programme. unpublished.

[3] Komeri Ontario. 1998. Environmental Impact Assessment Review. South Pacific Regional Environment Programme, unpublished.

interfere with the environment rather than vice versa. However, this view is already changing with indications from several Pacific island countries that the inverse is now being taken into consideration to a certain degree. In the case of Fiji for instance, for any development that takes place near shorelines; wave actions, storm surges, etc. are taken into consideration. The multifarious linkages between development and environmental systems is recognised in Fiji's EIA guidelines:

"the relationship between a development project, people and the environment is interrelated. Therefore, it is dynamic and changeable. People affect the environment in which they live and are affected, in turn, by changes in the environment".

In other Pacific Island countries, climate-related hazards are taken into consideration on a project-by-project basis.

5.1 EIA Status in the Pacific

Most PICs have addressed the need to establish formal EIA procedures at the national level by including EIA under a policy or act of government. The Cook Islands formally established their EIA procedures under the national *Cook Islands Environment Act 2003,* whereas in the past EIA enforcement was limited only to one island, Rarotonga, under the *Rarotonga Environment Act 1994-1995*. The current *Cook Island's Environment Act 2003* is an umbrella framework law applicable nationwide to all 15 islands, although local island governments are responsible for setting individual regulations and bylaws on EIA under the Act.

In January 2004, Samoa passed the *Planning and Urban Management Act 2004* that include EIA as a sub-section of the Sustainable Development Planning Section of the Act. Since 1987, Vanuatu has had an *ad hoc* arrangement for EIA, however, the status changed in March 2003 when EIA was legalised under the *Environmental Management and Conservation Act No. 12*. Although Fiji has not had any institutional framework governing the EIA system, the EIA procedures were established in 1980 by an inter-departmental Environmental Management Committee (EMC), created during the implementation of the Development Plan 7 provision. EIA has already been in operation for the past 13 years, and should be legally recognised once the *Sustainable Development Bill* (SDB) submitted to Cabinet is approved.

In the SPREP review, it is also recognised that many PICs believe that more work needs to be undertaken to enable:

- Equitable administration of EIAs
- Acquisition of skills and experience through on-the-job and organized training
- Integration of EIA processes with physical development processes
- Explicit criteria and guidelines for development and environmental protection
- (For the more advanced PICs) the use of Strategic EIA for land use, policy assessment and means to satisfy Multilateral Environmental Agreements (MEAs)
- Improvements in the methods and benefits that may accrue from early public participation in development-environment protection debates
- Better information and standardized data to assist in EIAs and other associated decision-making.

5.2 Possible Modalities for Incorporating Climate Change Impacts into the EIA Process

For most PICs, the EIA process has been established in one form or another (legislative frameworks or policy process). Despite these being in operation for a number of years, however, it is recognised that there are opportunities for improvement. Natural hazards, climate change, variability and extreme events are causing havoc globally, destroying lives and livelihoods – and associated costs are astronomical. There is a need to take these issues seriously as, according to the *IPCC Third Assessment Report*, frequency and intensity of such events may increase in future because of warming of the atmosphere. In this regard, it is recommended that for the Pacific, the incorporation of climate change considerations into the EIA process should be by the following EIA supportive instruments:

i) Terms of Reference

ii) EIA Review Sheet/checklist

iii) Compliance and Monitoring Systems

iv) Establishment of Formal EIA Procedures

v) EIA Experts Roster.

Some countries like Samoa and Fiji, are more advanced in their EIA and associated planning processes and have called for more advanced Strategic Environmental Assessment (SEA) approaches to assess policies, programmes and plans, and incorporating the use of Environment Management Plans based on ISO14000 to steer towards post-development compliance and monitoring.

5.2.1 Terms of Reference (ToR)

The Pro-forma ToR to be developed for projects within highly vulnerable environments such as coastal zones, flood plains, wetlands and sloping lands should specifically include detailed analysis to cover climate change, variability and sea level rise issues.

5.2.2 EIA Review-Sheet/ Checklist

The EIA checklist should be reviewed to specifically incorporate natural hazard and climate change issues. Current checklists of most PICs focus largely on the assessments of natural resources, social and cultural issues, policy and plan, as well as relationships to other activities. Neither natural hazards nor climate change are specifically mentioned in most EIA checklists. Since natural hazards and climate change are becoming major issues of concern for the Pacific and Small Island Developing States, it's best that these emerging issues – that are in part due to anthropogenic interferences – are clearly identified at the earliest possible stage during an EIA process to be seriously addressed by further developmental considerations. It is important also to identify these issues in the EIA review sheet so that the proponent as well as the reviewer will be working from a common platform, thus maintaining consistency. Such identification also guards against inconsistencies and lowering of standards as staff turnovers occur over time.

5.2.3 Compliance, Monitoring and Evaluation Systems

Often very little attention is paid to compliance, monitoring and evaluation systems of the EIA process, which defeats the whole purpose of conducting an EIA study. Compliance, monitoring and evaluation are ignored due to limited human and financial resources in the environment agencies. To overcome this constraint, it is proposed that a Memorandum of Understanding (MoU) could be developed with Municipalities, Rural Local Authorities, Civil Societies, Communities or any other party as need arises to assist in monitoring. It must also be noted that monitoring will not only ensure that an Environmental Management Plan (EMP) is fully realized but also provide key indicators to develop adaptive measures associated with climate change.

The Environmental Management Plan (EMP) is an important outcome of the environmental assessment process. If the situation demands, the EMP should outline the environmental protection measures to prevent or minimize adverse effects of climate change associated with specific developments. Often the monitoring plan is a component of the EMP that outlines the objectives of monitoring, the specific information to be collected and the programme management. Programme management, on the other hand, includes: assigning institutional responsibility, reporting requirements, enforcement capability and ensuring adequate resources are available.

5.2.4 Establishment of Formal EIA Procedures

Some countries in the Pacific Region have formal EIA procedures in place. There are several countries in the region however, that still need to establish formal/legal procedures. To facilitate the integration of environmental impact assessments into economic and physical development processes, the ideal scenario would be for the accommodation of EIA provisions, procedures, and jurisdiction, within planning frameworks. By formalising the EIA process, the institutional framework is established to incorporate climate change and natural hazards into the EIA process. This will then be supported by actions to stimulate the awareness of, and understanding by EIA Administrators of the severity of climate change and natural hazards on development activities. However, the circumstances of many PICs means that this scenario remains further down the track.

FIGURE 28 – Status of EIA Institution and Practice in Pacific Island Countries and Territories

COUNTRY	FORMAL EIA Leg Provisions/ Regs	Enacted/ Practiced	Integrated to Physical Development & Activities?	Adequate Guidelines/ explicit criteria	Able for Strategic EA and Policy	Able to satisfy MEAs eg CC, CBD?	Participation of Community
American Samoa	Yes USA EPA	Yes	?	?	?		
Cook Islands	Yes, 1995 then 2003	Yes	Sign dev.				
Fed States of Micronesia	No						Yes
Fiji	Yes, 1980 then 2003 SDB?	Yes	Sign Dev?	Yes?		Through Scoping	Yes
French Polynesia							
Guam	Yes USA EPA	Yes	?	Yes problems with applicability	?		
Kiribati	Yes	Yes	Sign Dev	More required			Yes
Rep of Marshall Islands	Yes USA EPA?	Yes	?		Yes		
Nauru							Yes
New Caledonia							
Niue	Env Bill, 2003 Draft Env Plng Bill	Yes	Awaiting Env Plng Bill	Yes	Yes?		Yes
Northern Mariana Islands							
Palau							
Papua New Guinea	Yes						
Samoa	Yes, 1993, now 2004 PUMA	Yes	Fully integrated	Yes	Yes?	Yes	Yes
Solomon Islands	Yes						Limited
Tokelau	No						
Tonga	Yes						
Tuvalu							
Vanuatu	Yes, 2003	Awaiting Regs/ EIA provisions	Linkages improved	No	Some	Y (CBD)	Limited
Wallis and Futuna							

Source: SPREP, 2003

5.2.5 EIA Experts Roster

It is recommended that a roster of experts be developed in PICs to undertake the climate change and natural hazard component of the EIA. Such a roster would trigger internal quality control and reliability in formulating EIA reports.

5.3 Integration of Climate Change Adaptation into the EIA Process within Pacific Island Countries - Practical Considerations

5.3.1 Cook Islands

In the Cook Islands the EIA process is mandated under the *Environment Act* 2003. This Act provides for the protection, conservation and management of the environment in a sustainable manner. The EIA provision falls under Section 36 and states in subsection (1): *"No person shall undertake any activity which causes or is likely to cause significant environmental impacts except in accordance with a project permit issued under this section."* Under the Act: *"every person commits an offence who, without reasonable excuse or lawful justification, fails or refuses to comply with subsection (1), and shall upon conviction be liable -*

a) in the case of a body corporate, to a fine not exceeding $100,000;

b) in any other case, to a fine not exceeding $50,000."

The EIA provision was first legislated under the *Rarotonga Environment Act* 1994-95. This Act only applied to the capital and main island and was later repealed and replaced by the *Environment Act* 2003, which entered into force on November 19, 2003. Prior to these Acts was the *Cook Islands Conservation Act* 1987 had no EIA provisions in place. The EIA provision was first implemented in 1996, after several workshops and trainings with both local, regional and overseas experts. In addition to the Act there is a draft *EIA Management Guideline* completed in July 1999, which has been forwarded to SPREP for further review. However with the new Act in place, there is a need for the *Guideline* to be updated and to incorporate all islands, since Rarotonga was the only island covered originally.

The *Environment Act* 2003 has clear legal provisions that prescribe the institutional duties and rights of the Environment Service, the lead agency in the EIA process. Within the Service the Compliance, Enforcement and Monitoring Division oversees the implementation of the EIA process as prescribed under the Act. In addition to the Environment Service other stakeholders include the Ministry of Works: involved with preparing and reviewing EIA Reports; Ministry of Health: involved with liquid waste disposal options; Traditional Leaders (Aronga Mana): involved with conservation and protected areas; and Engineers/ Environmental Consultants: involved with preparing EIA Reports and Reviewing (Peer-Review). There is an Island Environment Authority established by the Act for each island, which is the Permitting Authority that approves EIA Projects and issues project permits for development for that particular island. The Authority consists of representatives from NGOs, Health, Traditional Leaders, and all Mayors and Members of Parliament for that particular island.

The EIA process begins with the project owner (applicant) filling in the Environmental Significance Declaration Form (a checklist booklet) and a field visit by the Environment Service to the project site/area. Climate change issues are covered generally in the ESD Form, with sections on flooding, storm surges, erosion and drought. The ESD Form allows the Environment Service to determine whether an activity is likely to have a significant adverse affect on the environment and therefore whether an EIA is required or not. If the activity falls under this category then the applicant is required to apply for a project permit and an EIA Report is submitted with the application. Under the Act there are specific areas of concern: Foreshore and Cook Islands Waters, Sloping Land, Wetlands and Inland Waters. The majority of projects, which fall within these areas, require EIAs due to their vulnerable nature and sensitivity to change. EIA applications started off slowly from 1996-1999, however since 2000 there has been a marked increase in EIA applications lodged with the Environment Service, mainly due to the increase in tourism related developments, e.g., Hotel/Motel Accommodations.

Common examples of developments that require EIAs include:

- Tourism Accommodation (large scale, e.g., more than 3 units)
- Foreshore Protection (e.g., Rock Revetments, Coastal Protection Units (CPUs))
- Filling in of Wetlands
- Excavation on Sloping Land
- Dredging Lagoon/Harbours
- Industries (large scale)
- Harbour Development
- Airport Development.

Process

i. Letter of Advice (ToR): Advising the Applicant that an Environmental Impact Assessment is required

The Environment Officer advises the applicant in writing of the need for an EIA. The letter will clearly identify the areas of concern that need to be addressed.

ii. Applicant employs qualified engineer/environmental consultant

The applicant will employ a qualified engineer or environmental consultant to prepare and complete the EIA. The Environment Service has a list of recommended local Engineers/Environmental Consultants, and this is made available to the applicant.

In addition, the applicant will provide the following information to the employed engineer/ environmental consultant and the information will be included in the EIA:

- A site map/plan indicating the location of the development
- An engineering report if excavation is involved
- Information on the waste treatment system for proposed residential /tourism accommodation/industrial development/waste facilities
- A letter of support from the main community groups and the neighbouring areas
- Water/power supply acknowledgement letter.

iii. Independent review

In situations where the Environment Service is not qualified to make their own analysis of the report, the Environment Service contracts with an Engineer or Environmental Consultant to review the EIA report and ensure that all outstanding concerns identified in the Letter of Advice to the applicant have been addressed. In these situations, the Environment Service is responsible for payment of contracting services. If the outstanding concerns have not been addressed, then the matter is referred back to the applicant's engineer.

iv. Public Consultation

If all outstanding issues are satisfactorily addressed:

- The Applicant pays a fee of NZ$500 to the Environment Service. This fee covers the cost of report printing, newspaper and television advertisements. The advertisements are to advise the public about the project permit application and the location of the EIA report for public viewing and comments.
- The EIA Report is placed in a number of public areas, including shops, markets, cafes and supermarkets (especially near the project site), libraries, banks, and the Environment Service Office for 30 days. Details of how to make a written response to the Environment Service are included. Written comments from the public are invited.

v. Memorandum for the Island Environment Authority

The EIA Report and any public comments are collected. The Environment Officer develops a Memorandum, with recommendations and conditions.

vi. Island Environment Authority Meeting

The Memorandum, the EIA Report and Public comments are submitted to the Island Environment Authority for project permit approval, deferral or refusal/non-approval.

vii. Approval

If approved, the Island Environment Authority Chairperson signs the project permit, with conditions. A covering letter is signed by the Director of the Environment Service and attached with the project permit. The Applicant is advised to collect the approved and signed Project Permit.

viii. Deferral

If deferred, the applicant is requested to submit modifications regarding the proposed project or submit outstanding information. After the above has been completed the project is resubmitted to the Island Environment Authority.

ix. Refusal/Non-approval

If refused, the applicant is advised regarding the refusing of a permit for the proposed project and stating the reasons for such refusal. The applicant may, by letter to the Minister (within 14 days of receiving notice of a refusal), request that the Minister reconsider the Authority's decision.

Once the Permitting Authority issues the project permit, the Environment Service monitors the project during the construction and operation phase. At the end of the construction phase it is a requirement that the Engineer together with the Project Owner

submit to the Environment Service – within 10 days after the date the proposed work is completed – a report verifying completion of the proposed work and verifying compliance with all activities approved by the Permitting Authority.

5.3.2 Fiji Islands

Policies and Legislations

There is no mandatory legal requirement for EIA in specified circumstances, although the *Sustainable Development Bill* (SDB), under consideration since 1997, proposes this. In the early days, government established an inter-ministerial Environmental Management Committee (EMC) to advise Director of the Department of Town and Country Planning (DTCP) on the implications of the development proposals. In 1981, a consultant was commissioned by the government to prepare suitable procedures for incorporating EIA techniques in the Fiji's planning framework. In the late 1980s the government established an Environmental Management Unit (EMU) that dealt with various EIAs. Later in 1993, EMU was upgraded to a Department, giving it responsibility but no legal mandate for EIAs.

Currently, the *Town and Country Planning Act* 1946 Cap 139 has given the Fijian state the discretion to require such environmental assessments. The discretionary power of the Director of the Department of Town and Country Planning (DTCP) has been the trigger for many of the EIAs prepared in Fiji since early 1980s. The Director (TCP) uses EIA along with other considerations, when making decision on any proposed development. The Director's discretion in this instance applies only to private developments and not to government proposals. Since mid 1990s government projects funded by donor agencies are subjected to an EIA process. The Director of Town and Country Planning's discretion does not extend to the municipal councils, which have approved planning schemes, or the mining sector, which is controlled by the Director of Mineral Resources. It is envisaged that this situation will soon change once the SDB is enacted. In the SDB, the three

Integrating Climate Change Adaptation Considerations into the Cook Islands EIA Process:

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the EIA process in the Cook Islands.

a) Terms of Reference (ToR)

It is recommended that climate variability and change issues be specifically considered in ToRs of projects that are proposed in highly vulnerable environments such as coastal zones, flood plains, wetlands and sloping lands for some detail assessment.

b) EIA Review-Sheet/Checklist

It is recommended that the current EIA checklist be reviewed to specifically incorporate natural hazard and climate change issues.

c) Compliance, Monitoring and Evaluation Systems

It is recommended that Memorandum of Understanding (MoU) be developed with Island Environment Authorities, Non Government Organisations, Communities and other parties to assist in the monitoring of EIA mitigation measures recommended.

d) Establishment of Formal EIA Procedures

It is recommended that support be provided to the new Island Environment Authorities to enable regulations be enacted that can provide certainty and clarity to the EIA process for the outer islands, so that a proper national framework for regulating, administering and managing EIAs is evident. Such legislation should allow for the clear identification of the obligations and duties of the proponent and the authorities responsible for administering the EIA process.

e) EIA Experts Roster

The Cook Islands has one engineering firm that employs most of the relevant EIA experts in the Cook Islands making "independent assessment" awkward and expensive at times. It is recommended that training in the integration of climate change considerations be provided to EIA practitioners so that a roster of experts can eventually be developed to undertake the climate change and natural hazard component of the EIA. Such a roster would trigger internal quality control and reliability in the development of the EIA report.

categories of development are clearly defined. Category A activities will be dealt by the Department of Environment (DOE). Category B will be managed by the existing Approving Authorities. Category C is exempted from an EIA.

EIA Exemption

Proposals that do not require an Environmental Impact Assessment are as follows:

- a proposal for the construction of a single-family residential building in an approved residential development area, provided the construction does not encroach into the coastal zone and is at least 30 meters from any river or stream
- a proposal for an addition to an existing residential dwelling if the addition is to be used only for residential purposes, does not encroach into the coastal zone and is at least 30 meters from any river or stream
- a proposal for the construction of a traditional or customary structure made from traditional materials, or from natural rock, sand, coral, rubble, or gravel, if the construction does not encroach into the coastal zone and the structure is at least 30 meters from any river or stream
- a proposal for emergency action
- any other class of development proposal exempted from the EIA process by the Minister by regulation.

Process

i. Screening and Scoping

Under the current practice, the Director of TCP forwards the development applications to the Director of Environment to manage EIAs. DOE, through a scoping exercise, develops terms of reference for the study. Scoping is jointly undertaken by key line ministries and within 30 days after receiving the development application a Terms of Reference (ToR) is issued to the proponent. To accelerate the process, a consultant paid by the proponent could also draw up the ToR. A scoping meeting is then organized by the consultant to present the ToR to the key stakeholders at the meeting. These could contribute to the discussion and propose additions or deletions to the ToR. If a ToR is prepared by a consultant then that ToR must be approved by the lead agency to ensure that all the issues of importance to the decision-makers are addressed. Without a written approval on the ToR the

Integrating Climate Change Adaptation Considerations into the Fiji Islands EIA Process:

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the EIA process in the Fiji Islands.

a) Terms of Reference (ToR)

The ToR to be developed for projects that are proposed for highly vulnerable environments such as coastal zones, flood plains, wetlands and sloping lands; it is recommended that climate change, variability and sea level rise need to be specifically included as issues that need some detail analysis.

b) Compliance, Monitoring and Evaluation Systems

Often very little attention is paid to compliance, monitoring and evaluation systems of the EIA process, which defeats the whole purpose of conducting an EIA study. Compliance, monitoring and evaluation are ignored due to limited human and financial resources in the Environment Agencies. To overcome this constraint, it is proposed that a Memorandum of Understanding (MoU) could be developed with Municipalities, Rural Local Authorities, Civil Societies, Communities or any other party to assist in monitoring. It must also be noted that monitoring will not only provide key indicators to develop adaptive measures associated with climate change but also ensure that the Environmental Management Plan (EMP) is fully realized.

c) Establishment of Formal EIA Procedures

By formalising the EIA process, the institutional framework is established to incorporate emerging issues such as climate change and natural hazards into the EIA process.

d) Accredited Consultants

It is recommended that a roster of experts be developed in PICs to undertake the climate change and natural hazard component of the EIA. Such a roster would trigger internal quality control and reliability in the development of the EIA report.

consultant can not proceed with the study.

ii. Public Consultation

During the EIA process, public consultation is crucial. At three stages the public could be consulted on the development activities: first, during the scoping stage; secondly throughout the EIA study and finally during the review process. The public consultation process is clearly described in the SDB.

iii. EIA Study

Considerable amounts of fieldwork are usually performed in an EIA study in predicting impacts. It is important that a thorough EIA report be prepared by skilled and experienced professionals for technical aspects of the EIA. To overcome lack of expertise for conducting actual EIA study, it is proposed in the SDB that line ministries or consultants could carry out technical studies, paid for by the proponent. However, to maintain impartiality, the line ministry/department involved in the EIA study is not part of the scoping or review team. The review team is at liberty to review the EIA study or hire a consultant to assist in the reviewing exercise.

iv. EIA Review

EIA reports are reviewed by a review team, which is formed on an *ad hoc* basis involving the type of experts required. A checklist is available for the EIA review team to ensure that the environmental assessment is complete and the ToR have been adhered to. During the review process the review team may:

- request any organization to submit in writing any matter contained in the report
- request copies of any report, study or document mentioned in the report
- require proponent to carry out any further study or submit additional information
- require an independent review by a technical specialist.

v. Decision on EIA

Recommendations arising out of the review exercise are transmitted to the DTCP for decision-making on the development application. Often the EIA recommendations are translated into consent conditions by the DTCP. An approval may be subject to a requirement of an environmental bond to cover the estimated cost of preventing, mitigating or rehabilitating any environmental damage to the site.

vi. Appeal

Under SDB, the proponent may appeal to the Environmental Tribunal within 21 days, if the EIA report is not approved.

vii. Compliance, Monitoring and Evaluation

Although the EIA procedure is well developed – including the availability of an EIA Guideline to the Approving Authorities and the proponent – it must be noted however, that the monitoring outcomes and consent conditions are a weak link in the Fiji EIA system.

5.3.3 Samoa

The EIA process for Samoa has been operational since 1989.[4] The then Economic and Policy Planning Division of the Treasury Department developed a framework to guide departments and agencies in the identification and submission of project proposals for approval and funding (for large scale projects). According to the framework, an EIA is required in the planning phase. In 1998, draft EIA regulations and guidelines were developed for the Division of Environment and Conservation Officers. These guidelines were again reviewed by BECA International Consultants in 2001. However, it was only recently that the EIA process is being legalised under the *Planning and Urban Management Agency Act* 2004 (PUMA Act 2004). The Act serves to establish the Planning and Urban Management Agency, and Section 8 (a) specifically provides for the fair, orderly, economic and sustainable use, development and management of land including the protection of natural and man-made resources and the maintenance of ecological processes and genetic diversity.

The Planning and Urban Management Agency (PUMA) of the Ministry of Natural Resources and Environment has the formal role of offering advice and guidance on all aspects of the EIA process, particularly the scoping phase, assisting developers as well as administering the public review. In the case of an application for development

[4] *The Department of Land Survey and Environment Act* 1989, part 8 Section 95(a)(ii) - principal functions of the Department under this Act shall be to advise on the 'the potential environmental impact of any public or private development proposal' Economic and Policy Planning Division of the Treasury Department developed a framework to guide departments and agencies in the identification and submission of project proposals for approval and funding (for large scale projects).

consent, the Agency may require an applicant to provide an environmental impact assessment in relation to the proposed development. Where the Agency decides that an environmental impact assessment shall be prepared, the format, structure, subject matter of any such assessment and any other related matter, shall be specified in writing by the Agency to the applicant and the applicant shall comply with the Agency's requirements under this section.

Integrating Climate Change Adaptation Considerations into the Samoa EIA Process:

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the EIA process in the Samoa.

a) Terms of Reference (ToR)

The ToR to be developed for projects that are proposed for highly vulnerable environments such as coastal zones, flood plains, wetlands and sloping lands; it is recommended that climate change, variability and sea level rise need to be specifically included as issues that need some detail analysis.

b) EIA Review-Sheet/Checklist

The EIA checklist should be reviewed to specifically incorporate natural hazard and climate change issues.

c) Compliance, Monitoring and Evaluation Systems

Often very little attention is paid to compliance, monitoring and evaluation systems of the EIA process, which defeats the whole purpose of conducting an EIA study. Compliance, monitoring and evaluation are ignored due to limited human and financial resources in the Environment Agencies. To overcome this constraint, it is proposed that a Memorandum of Understanding (MoU) could be developed with Municipalities, Rural Local Authorities, Civil Societies, Communities or any other party to assist in monitoring. It must also be noted that monitoring will not only provide key indicators to develop adaptive measures associated with climate change but also ensure that the Environmental Management Plan (EMP) is fully realized.

d) Establishment of Formal EIA Procedures

Although some countries in the Pacific Region have formal EIA Procedures in place, several countries still need to legislate these processes. Legislation or Acts of Parliaments should provide empowerment to the EIA process, however it does not stimulate the mainstreaming of emerging issues into the environmental impact assessments such as climate change and natural hazards. By formalising the EIA process, the institutional framework is established to undertake incorporation of emerging issues such as climate change and natural hazards into the EIA process.

e) EIA Experts Roster

It is recommended that a roster of experts be developed to undertake the climate change and natural hazard component of the EIA. Such a roster would trigger internal quality control and reliability in the development of the EIA report.

Notification of Application

The Agency, after receiving a development application shall cause the placement of a public notice of the application, and, by written notice, will inform relevant people who will or may be affected by the development. The Agency, where it considers appropriate, may also request that all or any of the notices be given by the applicant.

Referral to Relevant Authorities

The Agency, under the 2003 Bill, is also required to consult with every public authority that it considers relevant to the development application received. Likewise, if there are any sustainable management plans or draft sustainable management plans relating to the land, the subject of the development application. All relevant authorities shall consider every development application referred to it and may inform the Agency in writing that:

- It does not object to the granting of development consent; or
- It does not object if the development consent is subject to the conditions specified by the relevant authority; or
- It does object to the granting of the development consent on any specified ground.

The relevant authority may also give the Agency its comments on the application.

Submissions on Development Applications

The Agency will also receive submissions from persons who may be affected by a development application by way of objections or otherwise. A submission of objection must state how the objector would be affected by the grant of development consent. The Agency may reject an objection that it considers has been made primarily to secure or maintain a direct or indirect commercial advantage for the objector.

EIA Review Process

EIA review process is necessary and any member of the public can make a submission. A period of 30 days is available for submissions. After a review period, an Assistant CEO-PUMA forwards a recommendations on the EIA to the CEO who in turn forwards it along with the EIA to the Minister. Within 10 days the Minister reaches a decision on the proposal – either approving it, with or without conditions, or declining it. Whatever the decision, it is publicly advertised.

EIA Support from PUMA

Unless the situation dictates otherwise, PUMA does not undertake the EIA on behalf of applicants, including other government departments. Partly this is a resource issue: PUMA does not have the personnel available to take on such a commitment. PUMA under the Sustainable Development Section should, therefore, develop partnerships with applicants, including other government departments, to help applicants study and respond to the environmental implications of a proposal. Hence, PUMA is likely to be involved in offering advice and guidance on all aspects of the process. More specifically, PUMA would normally have a role to play in the scoping phase, assisting developers (usually through their consultants). In section 46 (b) the Agency considers all the matters, including any decision and comments of a relevant authority. PUMA also has the formal roles of administering the public review of the EIA and formulating advice to the Minister about the likely environmental implications of the proposal. These are further reasons for the Ministry not to undertake impact assessments. The position of PUMA as the administrator of the EIA process and reviewer of completed assessments must, as far as possible, be seen to be separate from the interests of applicants, if the public and other interested parties (e.g., resource development companies, donor agencies) are to have confidence and trust in the EIA process.

5.3.4 Vanuatu

Policy and Legislations

EIA in Vanuatu is mandated under the *Environmental Management & Conservation Act No. 12 of 2002*, formally legalised on March 10, 2003. Prior to this Vanuatu had an adhoc arrangement for EIAs. The provisions for the process of an EIA is provided under the Act but this is yet to be formulated and accepted.

It is legally constituted in Part 3, Division 1/11 of the *Environmental Management & Conservation Act No. 12 of 2002* that EIAs must be conducted for developments that are likely to have significant environmental impacts and /or social impacts.

Activities subject to an EIA include all projects, proposals or developments that will do or are likely to:

a) Affect coastal dynamics or result in coastal erosion

b) Result in the pollution of water resources

c) Affect any protected, rare, threatened, or endangered species, its habitat or nesting grounds

d) Result in the contamination of land

e) Endanger public health;

f) Affect important custom resources

g) Affect protected or proposed protected areas

h) Affect air quality

i) Result in unsustainable use of renewable resources

j) Result in the introduction of foreign organisms and species.

Integrated Planning

In Vanuatu the EIA is integrated into the physical planning process and other legal development frameworks. The Environment Department is the lead agency. The lead agency assesses applications, determines the need for EIAs, develops ToRs, publicises, registers, prepares EIA guidelines and carries out monitoring. The lead agency works collaboratively with core agencies including government ministries, departments, local governments, municipal councils and developers, who provide and coordinate the undertaking of preliminary EIAs.

At the moment, the Environment Department does not have an officer responsible for EIA. There is, however, a National Advisory Committee on Environment that screens and approves EIAs. The *Environmental Management & Conservation Act* provides that EIAs are to be prepared by individuals or companies on behalf of the developer, at the cost of the developer.

Process

When a ministry, government agency, provincial or municipal council receives an application for any project proposal or development activity it must:

- Send a copy of the all development applications to the Vanuatu Environment Department
- Within 21 days of receiving the development application conduct a Preliminary Environment Assessment (PEA).

If the project proposal or development activity is likely to cause environmental, social, economic or custom impacts and requires a full EIA, the ministry, government agency, provincial or municipal council must write to the project proponent within 21 days of receiving the application, requesting that a full EIA be conducted and directing them to contact the Vanuatu Environment Department to establish the Terms of Reference for the EIA. The project proponent is responsible for preparing the EIA and all associated costs. No development permit can be issued until after the EIA is complete and accepted.

If an agency decides there is no significant environmental, social or custom impact posed by the project proposal or development activity, the application is processed and the Vanuatu Environment Department must be advised within 10 days of the decision.

Upon receipt of an application the Director of Environment has 10 days to determine whether an EIA is required, 21 days for an EIA to be prepared if an EIA is required. Within 30 days after receiving written comments from the project proponent, the EIA report must be lodged in the Environmental Registry at the same time.

The Director of Environment must develop Terms of Reference for any work that is to be undertaken by the EIA, including a description of the scope of work required.

In developing the Terms of Reference, the Director must give special consideration to the need for consultation, participation and involvement of custom landowners, chiefs and other interested parties and may consult with the National Council of Chiefs for that purpose.

- The project proponent is responsible for the full cost of preparing the EIA report
- Consultation between the Vanuatu Environment Department, a range of stakeholders and the project proponent develops the Terms of Reference on which to conduct the EIA
- The project proponent submits the EIA report to the Vanuatu Environment Department which then makes recommendation to the Minister responsible for the final ministerial approval
- When a government agency is the project proponent, the application must be forwarded to the Director of the Vanuatu Environment Department who will conduct the PEA and decide on the need for an EIA
- When the Vanuatu Environment Department is aware of a project that has a high risk of impacting the environment it can directly request that an EIA be conducted.

Consultation

The public is invited to provide written submissions on the EIA report and when it is lodged in the Environmental Registry, the public, not specifying any single group of people, is allowed to look at the EIA reports. All costs associated with any public notice requirement are the responsibility of the project proponent.

For reviewing EIA reports, section 22 of the *Environmental Management & Conservation Act No. 12 of 2002*, states the following:

"After receiving and reviewing the EIA report, including any submissions made, the Director (of the Department of Environment and Conservation) may, by notice in writing, require the project proponent to correct any deficiencies and/or provide additional information."

Recommendations

Within 30 days after receiving the EIA report and any additional material required, the Director must review the report and make recommendation on the project,

Integrating Climate change Adaptation Considerations into the Vanuatu EIA Process:

It is recommended that the following measures be implemented to support the integration of climate change adaptation considerations into the EIA process in the Vanuatu.

a) Terms of Reference (ToR)

The ToR to be developed for projects that are proposed for highly vulnerable environments such as coastal zones, flood plains, wetlands and sloping lands; it is recommended that climate change, variability and sea level rise need to be specifically included as issues that need some detail analysis.

b) EIA Review-Sheet/Checklist

The EIA checklist should be reviewed to specifically incorporate natural hazard and climate change issues.

c) Compliance, Monitoring and Evaluation Systems

Often very little attention is paid to compliance, monitoring and evaluation systems of the EIA process, which defeats the whole purpose of conducting an EIA study. Compliance, monitoring and evaluation are ignored due to limited human and financial resources in the Environment Agencies. To overcome this constraint, it is proposed that a Memorandum of Understanding (MoU) could be developed with Municipalities, Rural Local Authorities, Civil Societies, Communities or any other party to assist in monitoring. It must also be noted that monitoring will not only provide key indicators to develop adaptive measures associated with climate change but also ensure that the Environmental Management Plan (EMP) is fully realized.

d) EIA Experts Roster

It is recommended that a roster of experts be developed to undertake the climate change and natural hazard component of the EIA. Such a roster would trigger internal quality control and reliability in the development of the EIA report.

proposal or development activity to the Minister. The Minister must consider the Director's recommendation and, within 21 days after receiving the recommendation, make a decision on the application for the project, proposal or development activity. The Director must advise the project proponent in writing of the Minister's decision within 14 days after the Director becomes aware of it.

ANNEX 1 Summary of Climate Change Scenarios for the Caribbean and South Pacific Regions

1.1 Climate Scenarios

Scenarios of future climate are based mainly on the output of atmospheric-ocean General Climate Models (or Global Circulation Models) AOGCM's. These use mathematical descriptions of atmospheric and oceanic motions, energy fluxes and water fluxes to simulate past, present and future climates. Past and present climates are used to validate the models. Future climate is driven primarily by forcing due to greenhouse gases and aerosol particles which tend to partly counteract the greenhouse effect. These human-induced influences now outweigh natural factors that affect global climate such as changes in solar radiation or volcanic emissions.

Greenhouse gas and aerosol forcing is estimated by means of scenarios of future emissions. These can have a very wide range depending on the future evolution of world populations, economies, energy use, the sources of energy used, and extent of deforestation or afforestation. Our present (2002) atmosphere has about 30% more CO_2 (the most abundant of the greenhouse gases) than in pre-industrial times. IPCC's range of emission estimates suggest that CO_2 concentrations could be as much as triple pre-industrial by 2100 or could be less than double pre-industrial concentrations by

FIGURE 29 - The Global Climate of the 21st Century

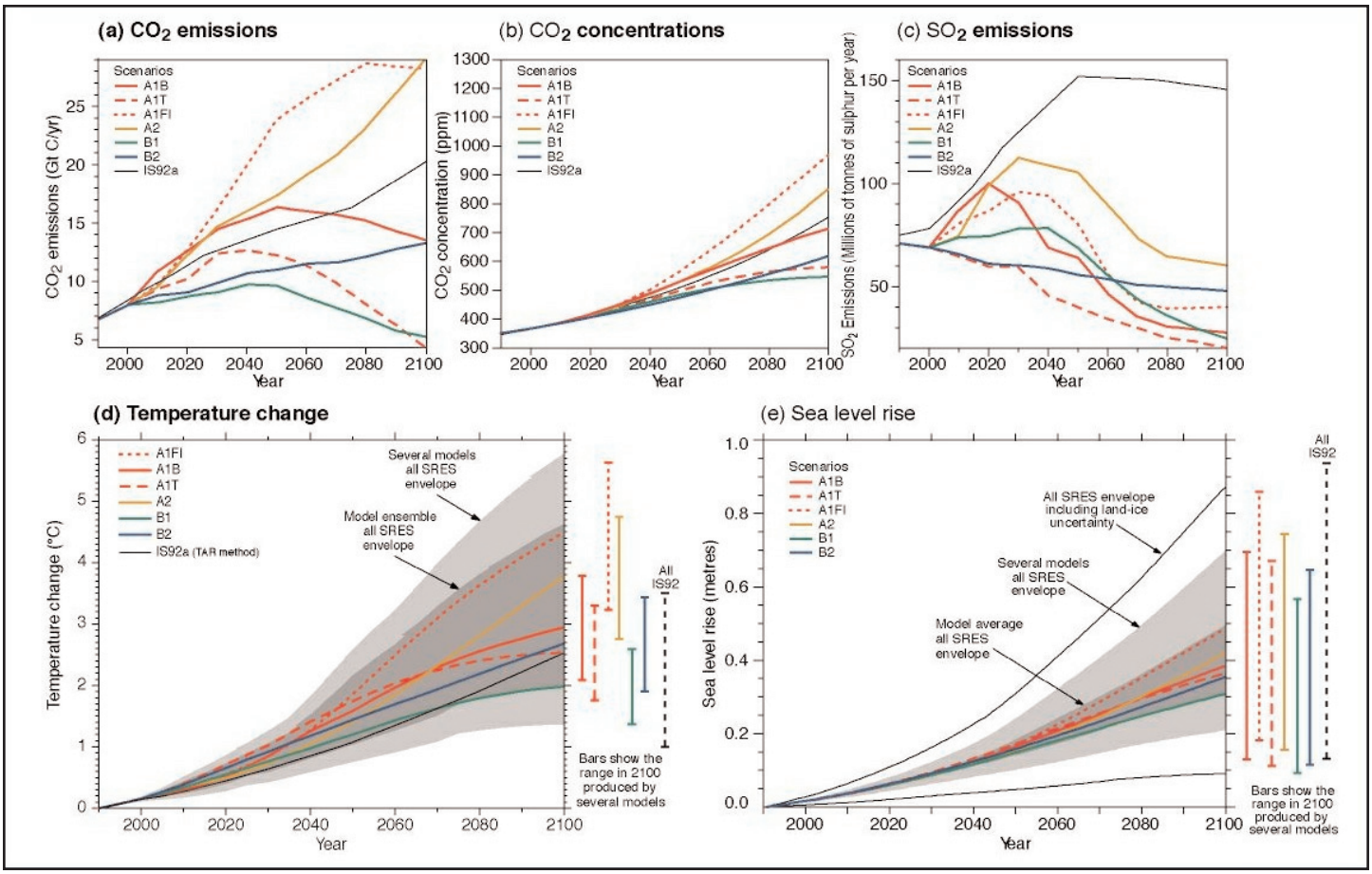


FIGURE 30 - The Emissions Scenarios of the Special Report on Emissions Scenarios (SRES)

The A1 storyline and scenario family describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions, capacity building and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income. The A1 scenario family develops into three groups that describe alternative directions of technological change in the energy system. The three A1 groups are distinguished by their technological emphasis: fossil intensive (A1F1), non-fossil energy sources (A1T), or a balance across all sources (A1B) (where balanced is defined as not relying too heavily on one particular energy source, on the assumptions that similar improvement rates apply to all energy supply and end-use technologies).

The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing population. Economic development is primarily regionally oriented and per capita economic growth and technological change more fragmented and slower than other storylines.

The B1 storyline and scenario family describes a convergent world with the same global population, that peaks in mid-century and declines thereafter, as in the A2 storyline, but with rapid change in economic structures toward a service and information economy, with reductions in material intensity and the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to economic, social and environmental sustainability, including improved equity, but without additional climate initiatives.

The B2 storyline and scenario family describes a world in which the emphasis is on local solutions to economic, social and environmental sustainability. It is a world with continuously increasing global population, at a rate lower than A2, intermediate levels of economic development, and less rapid and more diverse technological change than in the A1 and B1 storylines. While the scenario is also oriented towards environmental protection and social equity, it focuses on local and regional levels.

Source: Box 5 IPCC 2001, The Scientific Basis, Technical Summary

2100. The outcome depends primarily on the rate of growth of economies and of fossil fuel use and the vigour of measures to reduce the latter. This creates the greatest uncertainty in projections of future climate.

However, most climate model analyses have used simply a projection of greenhouse gas and aerosol forcing that increases at approximately the same rate as during the past decade. This also results in a range of outcomes because of the differences between models. Most of the available literature is based on such climate model analyses, and the following range of outcomes generally reflects these model differences, except as specifically noted. In cases where recent trends are consistent with projections, more confidence can be placed in the model outputs so some recent trends are cited. However where results are available using a broader range of future emission scenarios (the IPCC-SRES scenarios) these have been used (e.g., for sea level rise), and so reflect uncertainties in both future emissions and in the models.

To address the uncertainty associated with future climate change, two climate change scenarios – a 'low case' and a 'high case' scenario – are specified. These two scenarios are estimates of the range of potential economic impacts due to climate change to 2050 and 2080. These scenarios are based on the third assessment report of the IPCC, *Climate Change 2001*.

An increase in tropical cyclone (hurricane) peak wind and peak rainfall intensity are considered to be "likely" (65-90% confidence) by IPCC this century.

1.2 Summary of Climate Change Scenarios for the South Pacific Region

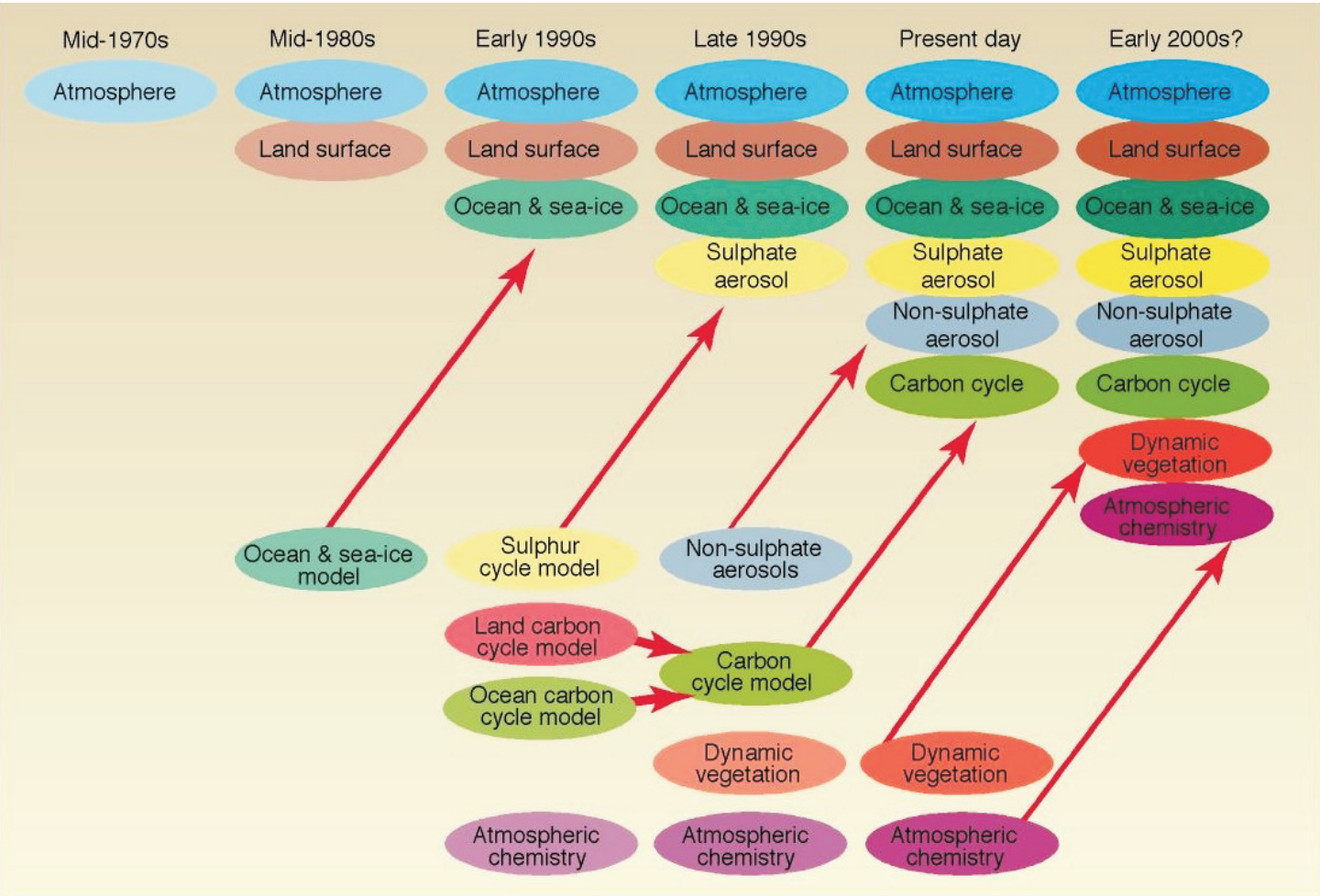
Six coupled atmosphere-ocean climate simulations were included in the analysis of regional climate change scenarios for the four South Pacific regions of Micronesia, Melanesia, and North and South Polynesia: CSIRO Mark 2 GCM with and without sulfate aerosols, CSIRO DARLAM 125 km, DKRZ ECHAM4/OPYC3 GCM, Hadley Centre HADCM2, and the Canadian CGCM1. The regional scenarios derived can be considered as projections that

represent a range of possible future climates.

Generally, the models project a temperature increase that is less than the global mean. Results show the least warming in the South Pacific; regional maximum warming is projected in the far west, central, and eastern equatorial Pacific. Four of the models show an increase in rainfall over the central and eastern Pacific over both half-years (i.e., May to October and November to April). Movements of both the ITCZ and the SPCZ were not consistent between models, but rainfall consistently increased. Increases in daily rainfall intensity are expected in regions where rainfall increases. They remain the same, or decrease slightly in areas of decrease in annual rainfall, as derived from several models and studies. High confidence is attached to this result.

Historical sea-level rise over the Pacific from tide gauge records adjusted for postglacial rebound is consistent with global estimates of 1-2 mm yr^{-1}. ENSO is the dominant influence on climate variability in the Pacific, and model outputs show that the ENSO phenomenon is likely to continue to 2100. The results also suggest that under climate change, there is likely to be a more El Niño-like mean state over the Pacific. There is no evidence that tropical cyclone numbers may change, but a general increase in *tropical cyclone intensity*, expressed as possible increases in wind speed and central pressure of 10-20% with $2xCO_2$ equivalent, now appears likely. Moderate confidence is attached to this result. No significant change in regions of formation was noted in the DARLAM 125 km resolution simulation, although this may alter in response to long-term changes to ENSO. Although there appears to be no major change in regions of origin, tropical cyclones

FIGURE 31 - The Develpment of Climate Models - Past, Present and Future



showed a tendency to track further poleward. Low confidence is attached to this result.

Based on global sea-level rise scenarios produced by the Hadley Centre (HADCM2 and HADCM3),[2] global sea levels are expected to rise by about 40 cm between 1990 and the 2080s. They project that many coastal areas are likely to experience annual or more frequent flooding, with the islands of the Caribbean and the Indian and Pacific Oceans facing the largest relative increase in flood risk. Projected out to the 2080s, the number of people facing high flood risk from sea-level rise in these regions would be 200 times higher than in the case of no climate change.[3] Recent studies for Cuba (based on HADCM2 and IS92a scenarios) also project that 98 coastal settlements with a combined population exceeding 50,000 persons would be inundated by a 1-m rise in sea level.[4]

1.3 Summary of Climate Change Scenarios for the Caribbean Region

1.3.1 Temperature and Precipitation (Caribbean)

Temperature increases by season for the two scenarios are shown in Table 2.1. The temperature increase for the low scenario is 2°C and for the high scenario is 3.3°C. Night time temperatures are projected to rise more than daytime temperatures, thus narrowing the daily temperature range by 0.3°C to 0.7°C.

TABLE 2.1: Temperature Increases by Season (Caribbean)

		Temperature Increase (°C) Scenario 1 (low)	Temperature Increase (°C) Scenario 2 (high)
Dec. - Feb.	2050	1.4	2.0
	2080	2.0	3.3
June -August	2050	1.5	1.9
	2080	2.0	3.3

NOTE: A decrease in the daily temperature range of 0.3°C to 0.7°C is projected with greater warming at night than during the day.

The precipitation scenarios are shown in Table 2.2. The low scenario shows decreases in precipitation throughout the year, with larger reductions during the rainy season. Precipitation is projected to rise under the high scenario, with a smaller increase during the rainy than during the dry season. It should be noted that the low and high values in the case of rainfall do not reflect low and high greenhouse gas emissions – they are simply the range of estimates from various sources.

The variation among model outputs for precipitation as reflected in Table 2.2 is very high. The median values for the scenarios suggest:

- less rain in the rainy season (-6.9% for 2050 and -8.2% for 2080), and
- more rain in the dry season (+5.9% for 2050 and +8.2% for 2080).

Three points tend to reinforce the likelihood of reduced precipitation, in the rainy season at least:

- In general, the Caribbean receives less rain in El Niño years and IPCC suggests that

TABLE 2.2: Precipitation Changes by Season (Caribbean)

		Precipitation Change % Scenario 1 (low)	Precipitation Change % Scenario 2 (high)
Dec. - Feb.	2050	-1.5	+13.1
	2080	-4.4	+24.4
June - August	2050	-18.4	+17.1
	2080	-25.3	+8.9

NOTE: A decrease in the daily temperature range of 0.3°C to 0.7°C is projected with greater warming at night than during the day.

[1]Jones, R. N. Hennessy, K. J., Page, C.M., Pittock, A.B., Suppiah, R., Walsh, K.J.E. and P.H. Whetton. 1999. *Analysis of the Effects of the Kyoto Protocol on Pacific Island States*. South Pacific Regional Environment Programme, Apia.

[2]Nicholls, N., Lavery, B., Fredericksen, C., Drosdowsky, W. and S. Torok. 1996. 'Recent apparent changes in relationships between the El Nino-Southern Oscillation and Australian rainfall and temperature', *Geographical Research Letters,* 23, pp. 3357-3360.

[3]Ibid.

[4]Perez et al., 1999

future climate may be more "El Niño-like."

- Trends in rainfall over the past few decades have been mostly downward in the Caribbean except for the northern islands of the Bahamas.
- Increased evaporation losses with higher temperatures will tend to overcome small increases in rainfall, with a net negative moisture balance especially in the rainy season.

1.3.2 Sea Level Rise (Caribbean)

Climate change causes sea levels to rise due to thermal expansion of ocean waters and melting of glaciers and ice on land. The range of mean sea level rise for the period 1990 to 2100 as estimated by five models is 0.18 to 0.77 metres. For the full range of economic and energy development in IPCC's emission scenarios (SRES scenarios), mean sea level rise of 0.16 to 0.87 metres is anticipated by 2100. The mean sea level rise for earlier periods is shown in Table 2.3.

There is a long lag time from greenhouse gas emissions to sea level rise, so that mean sea level would continue to rise for more than 1500 years. If emissions were held constant after 70 years at twice pre-industrial levels, sea level would eventually rise to between 0.5 and 2.0 metres above present levels.

To compare these projections to observed sea level rise to date, the longest observed record in the region is from Key West, Florida, where average increases of 0.17 m per decade have been observed since 1850. This is much more rapid than even the highest of the above projections for the Caribbean. The high projections thus seem more compatible with the observations to date. However, this should be tempered with the note that the northern Caribbean mean sea level increase, during the relatively short Topex/Poseidon satellite mission (1993-1998), was substantially greater than for the Southern Caribbean.

1.3.3 Extreme Events (Caribbean)

1.3.3.1 Storm Surges (Caribbean)

It is not the **mean** sea level that does the most damage to beaches and shorelines and causes major floods, but the extreme high water under storm surges, tides, and waves. Probability analysis shows that for a location about one metre above present mean sea level and a sea level rise of 20 cm, storm surges and tidal flooding which now occur every 10 years on average, would occur twice per year – a twenty-fold increase.

To indicate the potential magnitude of storm surge inundation, model calculations for a category 5 (most severe) hurricane approaching the Bahamas from the east, indicate a "maximum envelope of water" (MEOW) 5.2 m deep moving on shore in the Nassau area. The observed MEOW in the Bahamas from hurricane Andrew (category 4) was 2.4 to 3.0 m.[5]

1.3.3.2 Tropical Storms and Hurricanes (Caribbean)

Will tropical storms and hurricanes become more frequent or severe in a changing climate?

The historical record indicates that the:

- Number of hurricanes plus tropical storms (that did not reach hurricane intensity) in Atlantic-Caribbean basin has increased from 7 to 10 per year since 1886.[6]
- Number of hurricanes alone shows no long-term trend, but annual numbers are affected by the state of ENSO (fewer during El Niño and more during La Nina conditions), so a more "El Niño-like" climate would mean fewer hurricanes.
- Number of hurricanes reached the unprecedented number of 4 during 1999.

The climate change scenarios are presented in Table 2.4. The trend in the number of tropical storms and hurricanes is uncertain, so the number remains at 10 per year for both scenarios. The number of

Table 2.3: Mean Sea Level Rise (Caribbean)

SRES Mean Sea Level Changes		
	Scenario 1 (low)	Scenario 2 (high)
2050	0.08m	0.44m
2080	0.13m	0.70m
eventual	0.5 m	2.0m

[5]Rolle, The Bahamas Meteorological Service, personal communication.

[6]Martin and Weech, 2001.

severe hurricanes (category 4 and 5 storms) is assumed to be 2 in the low case and to equal the 1999 level of 4 in the high case. The intensity (maximum wind speed) of the strongest hurricanes is projected to rise by 5% in the low scenario and by 15% in the high scenario.[7]

Table 2.5 provides an estimate of the increase in insured losses with changes in hurricane intensity (maximum wind speed) for the United States. The losses increase exponentially – a 5% increase in maximum wind increases damages by approximately 35% and a 15% increase in maximum wind speed increases damages by roughly 135%. These percentage increases in losses likely apply in the Caribbean as well.

1.3.3.3 Heavy Rains (Caribbean)

Despite a decline in total rainfall, there has been an increase in rain intensity on rain days in Guyana, Suriname and some islands. Such heavy rains are due to tropical waves and upper level troughs in the inter-tropical convergence zone and cause local flooding. There were 46 cases of such events between 1955 and 2000 (46 years) in Barbados, most of which caused floods and a few of which caused wind damage.

Further increases in rain intensities are projected with one-day average rains increasing on average 0.5 mm (low) to 1.0 mm (high). The 20-year return period heavy one-day rainfalls over the Caribbean are approximately 80 mm/day on average (1973-93).

Table 2.4: Tropical Storms and Hurricanes (Caribbean)

	Scenario 1 (low)	Scenario 2 (high)
Number of tropical storms and hurricanes per year, 2050 and 2080	10	10
Number of severe hurricanes per year, 2050 and 2080	2	4
Increased wind speed of the strongest hurricanes, 2050 and 2080	5%	15%

Table 2.5: Loss Potential in Future Hurricanes (Caribbean)

Storm	Class	Year	Estimated 1990 Insured Losses (000's)	Estimated 1990 Insured Losses if Maximum Wind Speed Increases by		
				5%	10%	15%
Hugo	4	1989	$3,658,887	$4,902,705 34%	$6,514,172 78%	$8,542,428 133%
Alicia	3	1983	$3,658,887	$3,382,775 39%	$4,312,884 77%	$5,685,853 133%
Camille	5	1969	$2,435,589	$4,120,733 34%	$5,438,332 76%	$7,095,008 130%

Source: Clark, 1997.

These are expected to increase by an average over the region of 15 mm/day (20%) by 2050 and 35 mm/day (40%) by 2090. These estimates are used as the low scenario in Table 2.6. No other literature is available as the basis for the high scenario.[8]

The number of flooding events from short-duration intense rainfalls and the amount of flooding per event are thus projected to increase, even though total rainy season rainfall is likely to continue to decline.

TABLE 2.6: Heavy Rains (Caribbean)

	Scenario 1 (low)	Scenario 2 (high)
One day average rainfall, 2050 and 2080	+0.5 mm	+1.0 mm
20 year return period one-day rainfall 2050 2080	 95mm 110 mm	

[7]Houghton, et al., 2001.

[8]Zwiers and Kharin, 1998 and Kharin and Zwiers, 2000.

ANNEX 2 Climate Change Induced Hazards

Landslides

The term landslide includes slides, falls, and flows of unconsolidated materials. Landslides can be triggered by earthquakes, volcanic eruptions, soils saturated by heavy rain or groundwater rise, and river undercutting. Earthquake shaking of saturated soils creates particularly dangerous conditions. Although landslides are highly localized, they can be particularly hazardous due to their frequency of occurrence. Classes of landslide include:

- Rockfalls, which are characterized by free-falling rocks from overlying cliffs. These often collect at the cliff base in the form of talus slopes which may pose an additional risk.
- Slides and avalanches, a displacement of overburden due to shear failure along a structural feature. If the displacement occurs in surface material without total deformation it is called a slump.
- Flows and lateral spreads, which occur in recent unconsolidated material associated with a shallow water table. Although associated with gentle topography, these liquefaction phenomena can travel significant distances from their origin.

The impact of these events depends on the specific nature of the landslide. Rockfalls are obvious dangers to life and property but, in general, they pose only a localized threat due to their limited areal influence. In contrast, slides, avalanches, flows, and lateral spreads, often having great areal extent, can result in massive loss of lives and property. Mudflows, associated with volcanic eruptions, can travel at great speed from their point of origin and are one of the most destructive volcanic hazards.

Flooding

Two types of flooding can be distinguished: (1) land-borne floods, or river flooding, caused by excessive run-off brought on by heavy rains, and (2) sea-borne floods, or coastal flooding, caused by storm surges, often exacerbated by storm run-off from the upper watershed and sea-level rise associated with climate change. Tsunamis are a special type of sea-borne flood.

a. Coastal flooding

Storm surges are an abnormal rise in sea water level associated with hurricanes and other storms at sea. Surges result from strong on-shore winds and/or intense low pressure cells and ocean storms. Water level is controlled by wind, atmospheric pressure, existing astronomical tide, waves and swell, local coastal topography and bathymetry, and the storm's proximity to the coast.

Most often, destruction by storm surge is attributable to:

- Wave impact and the physical shock on objects associated with the passing of the wave front.
- Hydrostatic/dynamic forces and the effects of water lifting and carrying objects.

The most significant damage often results from the direct impact of waves on fixed

structures. Indirect impacts include flooding and undermining of major infrastructure such as highways and railroads. Flooding of deltas and other low-lying coastal areas is exacerbated by the influence of tidal action, storm waves, and frequent channel shifts.

b. River flooding

Land-borne floods occur when the capacity of stream channels to conduct water is exceeded and water overflows banks. Floods are natural phenomena, and may be expected to occur at irregular intervals on all streams, and rivers. Settlement of floodplain areas is a major cause of flood damage.

Hurricanes

Hurricanes are tropical depressions which develop into severe storms characterized by winds directed inward in a spiraling pattern toward the center. They are generated over warm ocean water at low latitudes and are particularly dangerous due to their destructive potential, large zone of influence, spontaneous generation, and erratic movement. Phenomena associated with hurricanes are:

- Winds exceeding 64 knots (74 mi/hr or 118 km/hr), the definition of hurricane force. Damage results from the wind's direct impact on fixed structures and from wind-borne objects.
- Heavy rainfall which commonly precedes and follows hurricanes for up to several days. The quantity of rainfall is dependent on the amount of moisture in the air, the speed of the hurricane's movement, and its size. On land, heavy rainfall can saturate soils and cause flooding because of excess runoff (land-borne flooding); it can cause landslides because of added weight and lubrication of surface material; and/or it can damage crops by weakening support for the roots.
- Storm surge (explained above), which, especially when combined with high tides, can easily flood low-lying areas that are not protected.

Hazards in Arid and Semi-Arid Areas

a. Desertification

Desertification, or resource degradation in arid lands that creates desert conditions, results from interrelated and interdependent sets of actions, usually brought on by drought combined with human and animal population pressure. Droughts are prolonged dry periods in natural climatic cycles. The cycles of dry and wet periods pose serious problems for pastoralists and farmers who gamble on these cycles. During wet periods, the sizes of herds are increased and cultivation is extended into drier areas. Later, drought destroys human activities which have been extended beyond the limits of a region's carrying capacity.

Overgrazing is a frequent practice in dry lands and is the single activity that most contributes to desertification. Dry-land farming refers to rain-fed agriculture in semiarid regions where water is the principal factor limiting crop production. Grains and cereals are the most frequently grown crops. The nature of dry-land farming makes it a hazardous practice which can only succeed if special conservation measures such as stubble mulching, summer fallow, strip cropping, and clean tillage are followed. Desertified dry lands in Latin America can usually be attributed to some combination of exploitative land management and natural climate fluctuations.

b. Erosion and Sedimentation

Soil erosion and the resulting sedimentation constitute major natural hazards that produce social and economic losses of great consequence. Erosion occurs in all climatic conditions, but is discussed as an arid zone hazard because together with salinization, it is a major proximate cause of desertification. Erosion by water or wind occurs on any sloping land regardless of its use. Land uses which increase the risk of soil erosion include overgrazing, burning and/or exploitation of forests, certain agricultural practices, roads and trails, and urban development. Soil erosion has three major effects: loss of support and nutrients necessary for plant growth; downstream damage from sediments generated by erosion; and depletion of the water storage capacity because of soil loss and sedimentation of streams and reservoirs, resulting in reduced natural stream flow regulation.

Stream and reservoir sedimentation is often at the root of many water management problems. Sediment movement and subsequent deposition in reservoirs and river beds reduces the useful lives of water storage

reservoirs, aggravates flood water damage, impedes navigation, degrades water quality, damages crops and infrastructure, and results in excessive wear of turbines and pumps.

c. Salinization

Saline water is common in dry regions, and soils derived from chemically weathered marine deposits (such as shale) are often saline. Usually, however, saline soils have received salts transported by water from other locations. Salinization most often occurs on irrigated land as the result of poor water control, and the primary source of salts impacting soils is surface and/or ground water. Salts accumulate because of flooding of low-lying lands, evaporation from depressions having no outlets, and the rise of ground water close to soil surfaces. Salinization results in a decline in soil fertility or even a reduction in land available for agricultural purposes. In certain instances, farmland abandoned because of salinity problems may be subjected to water and wind erosion and become desertified.

Inexpensive water usually results in over-watering. In dry regions, salt-bearing ground water is frequently the major water resource. The failure to properly price water from irrigation projects can create a great demand for such projects and result in misuse of available water, causing waterlogging and salinization.

ANNEX 3 Modeling the Climate System and Future Scenarios

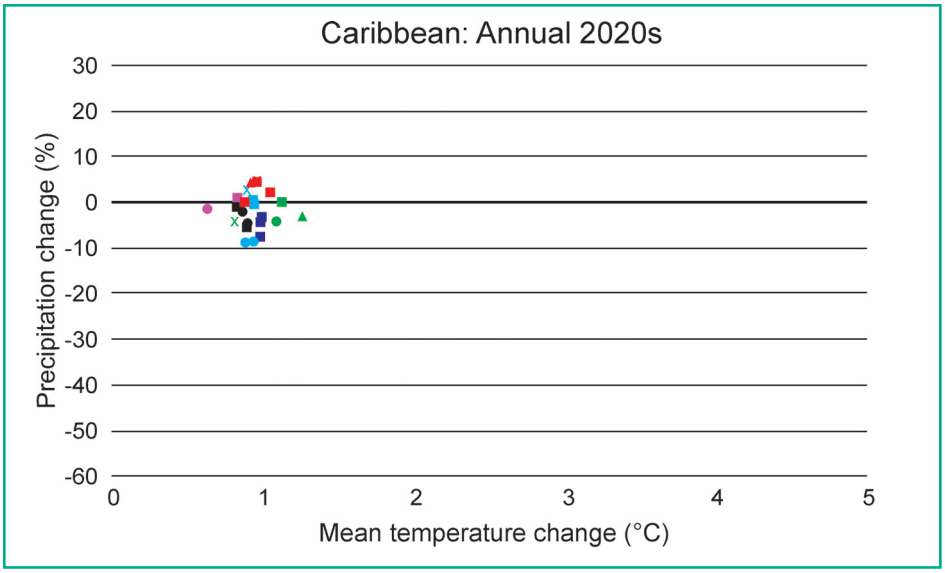
Earth's climate is a product of many complex processes. The source of energy which drives these processes is the sun. This energy is received predominantly in low latitudes near the equator and is re-distributed, permitting abundant life in temperate and polar zones. Re-distribution, in the short term, is through the winds of the atmosphere, induced on the turning world. In the longer term, ocean currents carry heat poleward from the tropics. The incoming energy from the sun is offset by radiation from the earth to space, some of which is intercepted by the greenhouse gases. Clouds and particles (aerosols) in the atmosphere affect these energy exchanges as does ice, snow, soil and vegetation, and the distribution of water on the globe.

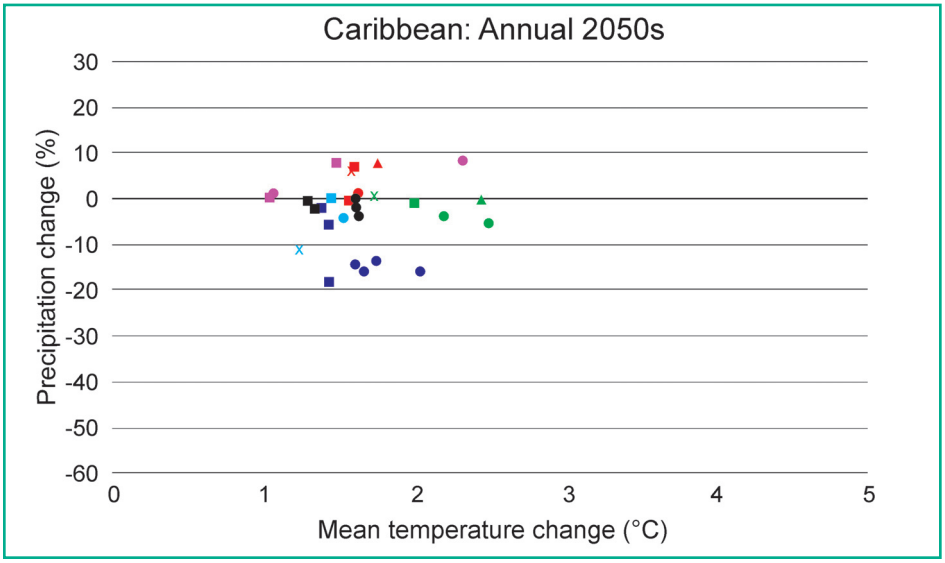
In short, while the system is understood in general, the sub-processes are so complex that their simulation is only possible with mathematical models requiring the most powerful high-speed computers available. Such models have been developed at some 15 climate research centres in the world. Each uses somewhat different ways to simulate, or parameterize, some of the processes – e.g. the hydrologic cycle, ocean-atmosphere interactions, cloud feedback, the role of vegetation, etc. In contrast to earlier global models that had a "fixed" ocean, more recent models include an interactive ocean, with simulated currents and temperatures. These are sometimes referred to as Atmosphere-Ocean General Circulation Models (AOGCMs).

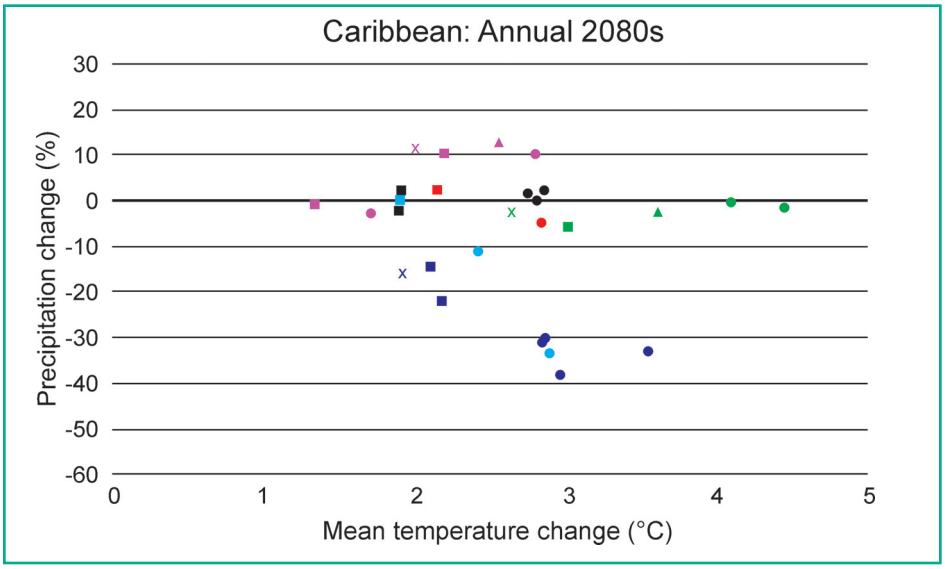
The remarkable thing is that, on a global or large continental scale, model simulations of future climate, with increasing concentrations of greenhouse gases in the global atmosphere, give similar but not identical results. This is mainly because the basic equations of motion of the atmosphere and oceans are well known and the equations describing the major energy fluxes are also well developed and proven. However, estimation of future emissions over this century of greenhouse gases, and aerosols which partly offset the greenhouse effect, are difficult. Such estimations are driven by assessments of future changes in population, economic development, energy technologies and land use (IPCC 2001). It turns out that at least half of the "uncertainty range" of the projected global warming of 1.4°C - 5.8°C over the 21st century (IPCC 2001) is due to this inability to accurately foretell future greenhouse gas and aerosol emissions, and therefore atmospheric concentrations observed in the region of interest. This yields a plausible range of future regional climate scenarios. Using existing climatic records for places of interest within the region (e.g., individual countries of the Caribbean), statistical techniques have been developed for downscaling results to a local level from the climate models' global projections. These permit more reliable projections of future climate over small areas.

In the longer run regional climate models, for example for the Caribbean, could be developed to

FIGURE 32 - Downscaled Climate Change Projections







be "nested" within an AOGCM. However, this requires substantial further scientific effort. Results will still be dependent on the reliability of the "parent" Globel AOGCMs. This regional modeling technique will be complementary to the statistical downscaling.

Thus scientific developments now permit determination of a range of most likely future climates and sea level rises. As the science progresses, the range will probably narrow. Uncertainties remain about the rates of change, but the directions of change are unmistakable and can form the basis for sound adaptation measures, using a risk management approach.

Selecting Scenarios of Future Climate

Since greenhouse gas concentrations in the global atmosphere have been rising sharply in the past three or four decades, some signals of human-induced climate change are already evident. Of the 17 or so AOGCM results now available, it is probably wise to rely on two or a few that best simulate the recent changes. For some variables not well simulated by the models, such as extreme events, extrapolation of the measured experience of the past 30 to 40 years, when greenhouse gas increases were the major influence

Downscaled climate change projections, averaged for the Caribbean, from outputs of a number of global climate models, based on a range of IPCC greenhouse gas emission scenarios. There is close agreement between projections of temperature rise and precipitation changes for 2020, somewhat greater scatter for 2050 but still reasonable agreement, but quite wide scatter for 2080. (*Source: Elaine Barrow, MSC, 2003*)

on climate change, can yield a useful range of future scenarios.

There are two major sources of uncertainty in AOGCM projections. They are: (1) uncertainty in the rate of increase of greenhouse gases (and aerosols) in the global atmosphere since they are a product of rate of population growth, economic growth and energy sources and practices – all notoriously difficult to predict, and (2) difference between models for a given greenhouse gas and aerosol future, because the AOGCM's use varying methods of mathematically expressing the many interactions in the global climate system.

Figure 34 on the previous page shows the changes in temperature and precipitation for the Caribbean as a whole, projected by some 30 combinations of models and scenarios of future emissions. It will be immediately noted that for 2020 there is very good agreement with results clustering around 0.8°C warming and little change in rainfall. For 2050 the agreement is somewhat diminished but most projections are in a fairly useable range of 1.3°C to 2.3°C warming and +5% to –15% change in rainfall. (It should be noted that increased evaporation at higher temperatures would offset any small increase in rain, which one model suggest and still result in dryer conditions.) However, for 2080 the scatter is quite large, primarily because amounts of greenhouse gas emissions over this century could exhibit quite a wide range, depending on world-wide energy policies, economic growth, etc.

Since climate planning beyond 2050 is rare, climate scenarios results to then can be readily adopted. Some down-scaling of these scenario results from the whole Caribbean to individual countries is being undertaken by statistical means by experts at UWI-Cave Hill and Mona campuses and the CARICOM climate unit (see www.caribbeanclimate.org).

ANNEX 4 Guide to the Use of Risk Management Procedures to Address Scientific Uncertainty

A guide has been developed to assist CARICOM country practitioners select and implement feasible options for adaptation to climate change. The guide adopts a risk management approach for addressing the uncertainties associated with the present status of our knowledge to climate change. The methodology employed in this Manual is based on the Canadian National Standards Association *Risk Management: Guidelines for Decision-Makers.* The Manual follows the key steps of this standard. It is also informed in terms of its approach to dealing specifically with climate change risks by the Comprehensive Hazard and Risk Management (CHARM) process developed and utilized by the Pacific Island countries.

Why do we need a Risk Management Process to help with Climate Adaptation Decisions?

One of the major environmental challenges facing the Caribbean is that of global climate change and increased climate variability which affects many aspects of Caribbean life and economy – agriculture, water availability, health, the coastal zone, tourism and, of course, the frequency and severity of disasters from storms, floods and droughts. Caribbean and Pacific governments, like other Small Island Developing States, have undertaken a strategy to adapt to climate change with the hope that by so doing, their social, economic and environmental systems would be able to better withstand the expected impacts of climate change.

Adapting to climate variability and change is a problem involving risks and choices.

The complexity of assessing the optimal course forward where there are uncertainties about the needs, the objectives, the process or the outcomes – or any number of other parameters – often encourages denial, delay or deferral of necessary action. The risk management process provides a framework for managing the selection of adaptation strategies for those aspects of climate variability and change impacts that create or increase a risk to the Caribbean and Pacific regions, their member states, citizens, infrastructure, economies and environment.

Risk management is a decision-making tool that assists in the selection of optimal, or the most cost-effective, strategies using a systematic, broadly accepted public process.

The inclusion of a wide variety of concerned stakeholders offers opportunities for raising awareness and bringing bright new ideas into the decision-making process. In addition, a carefully managed, information and science-based process with a secure and accessible document record will benefit all users of the results.

In this environment of uncertainty, a risk management approach is considered to be desirable for bringing some precision to the decision-making process involved in developing climate change adaptation options for implementation by countries. It will move toward a more measured regime of strategy

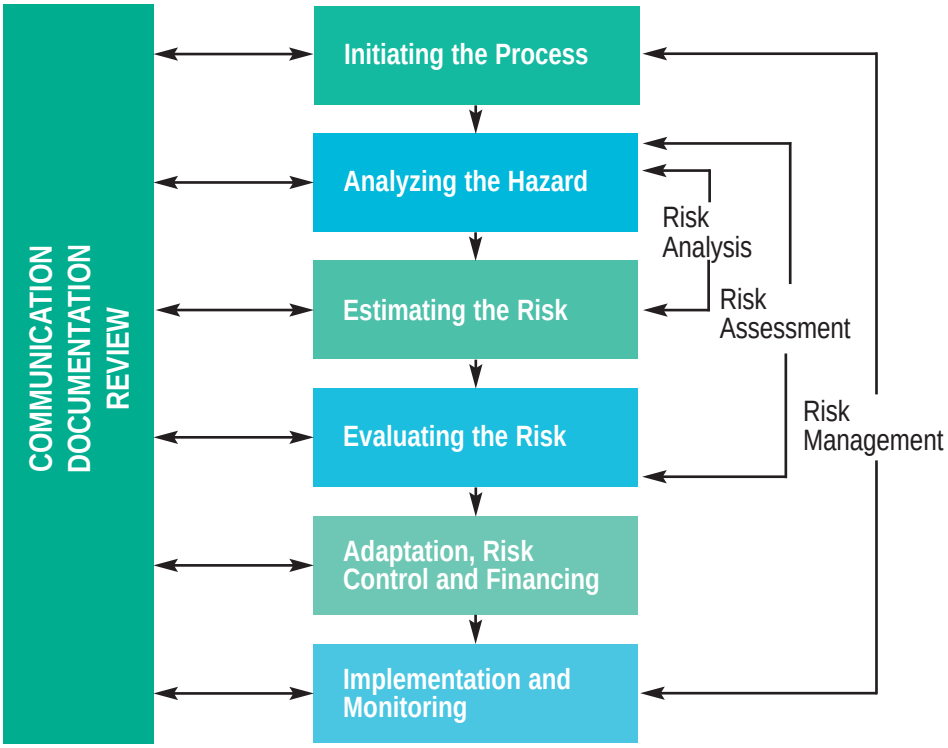
development, evaluation, continuous monitoring and results measurement – leading towards improvements in regional capacities and resilience.

To facilitate its use, each step in the risk management process is accompanied by a concrete example of how it is applied to address an actual risk arising from a climate hazard. It illustrates how this is dealt with from risk identification, through risk estimation, risk evaluation and finally the selection of risk control actions adaptation that should be implemented.

The risk management process used in EIA decision-making consists of the steps illustrated in *Figure 35*.

These are the main activities in the climate change component of the natural hazard risk management process that form the basis for the integration of natural hazard assessment into the EIA process. The various feedback loops ensure the process accounts for all information and perspectives. The figure also shows how the risk communications process with key stakeholders and the public integrates with all stages of the process. It also shows that records are kept of all significant activities throughout the EIA process. The process is explained in detail in the guide with an appropriate example illustrating each step to help understand the key elements.

FIGURE 33: Steps in the Natural Hazard Risk Management Process



ANNEX 5 Summary of Anticipated Impacts Resulting from Climate Change and Climate Variability in the Caribbean Region

Introduction

The following summary of potential impacts from climate change and climate variability in the Caribbean Region was developed during extensive regional and national stakeholder consultations undertaken for Component 4 of the Caribbean Planning for Adaptation to Climate Change (CPACC) project (1997-2001).

Beach and Shoreline Stability

The climate change factors that are most likely to impact coastal stability are sea level rise, changes in hurricane patterns and storm surges. In the small-island and low-lying coastal states of the region, the coastal zones usually have a high concentration of critical infrastructure, human settlement, and social and economic activity. For example, 90 % of the population of Guyana resides in the coastal strip where the main urban centres and commercial activities are found.

Beaches serve as buffer zones between the land and the water and many important birds, reptiles, and other animals nest and breed on the berm and the open beach. Sea turtles use many beaches in the Wider Caribbean to dig their nests and deposit their eggs. The beach also provides habitat for a multitude of burrowing species, such as crabs, clams, and other invertebrates. Beaches also have a significant economic value in the region as beach tourism is one of the major contributors to national economies. This is perhaps why there has already been significant interest and investment in coastal zone management all over the region.

Where coastlines are particularly vulnerable to incident waves (Dominica, Guyana and Belize) or where coastal areas are below sea level, as in the case of Georgetown, Guyana, sea defense structures have been erected. The present state of these structures is rather poor, although in the past few years rehabilitation programmes have been developed. Needless to say, increased storm surge activity and sea level rise impacting on inadequate structures and exposed areas can lead to complete inundation and lost lives in some cases, and biodiversity will be affected both directly and indirectly. Lost infrastructure and the consequent effect on economic activity can reduce opportunities for social and economic development.

Marine Ecosystems

Marine ecosystems in the Caribbean consist principally of coral reefs, sea-grass beds, mangroves and other wetlands.

Coral Reefs

For coral reefs to grow and remain healthy the seawater in which they live must be shallow, clear, clean and warm. Water temperatures must remain between 18 and 30 degrees Celsius through out the year. A coral reef ecosystem provides a number of natural services and functions that are of economic importance to Caribbean countries. Some of these coral reef functions and services are:

- The generation of the white sand that forms many of the beaches in the Wider Caribbean region

- Natural attractions and a focus for a number of forms of tourist and local recreation, providing income from these activities
- Natural breakwaters, protecting beaches, coastlines from erosion and infrastructure (roads, buildings, harbours) from direct exposure to and damage from waves, especially during storms
- Create natural protected bays and lagoons for recreational activities (swimming, water sports) and safe moorings for fishing and recreational vessels
- Provide habitat for economically valuable fishable resources (fish, lobster, crabs) to live and reproduce.

Despite what may seem as ideal conditions, coral reefs in the Caribbean continue to exhibit signs of stress and bleaching during ENSO[15] events. Anticipated sea level rise and increased ocean temperatures are likely to increase incidents of coral damage and mortality, thereby reducing their physiological functions.

Mangrove Communities

Mangroves are expected to respond to rising sea levels and saline intrusion by retreating shoreward.[2] This readjustment of mangroves will result in changing acreage and salinity levels and also affect the fish resources since some of the commercial species have nursery areas in the mangroves. Mangroves also serve as protection against storms, tides, cyclones and storm surges and are used as filters for nutrients and to stabilize substrates. If the mangrove forest has to re-establish itself at a new location then many valuable functions will be lost. At the local level, persons who depend heavily on fish as their main source of protein would be affected when fish stocks are reduced, especially when there is competition by commercial fisheries.

Though adaptable to natural climate variability, storms may damage mangroves severely as was the case of Gilbert in Jamaica.[3] These fragile ecosystems reach maturity in about 25 years and since the average inter-hurricane period for most of the region is less than that, their biomass is generally considered to be limited by hurricanes.[4]

Estuaries, Wetlands and Watersheds

Coastal areas of the Wider Caribbean near major watersheds often contain large lagoons of fresh or brackish water. Estuaries, coastal lagoons, and other inshore marine waters are very fertile and productive ecosystems. They serve as important sources of organic material and nutrients, and also provide feeding, nesting and nursery areas for various birds and fishes. These ecosystems act as sinks of terrestrial run-off, trapping sediments and toxins which may damage the fragile coral reefs. Fragile ecosystems in these areas are extremely vulnerable to climate change impacts.

Water Resources

In most countries, no systematic water monitoring programmes exist and this essentially undermines any attempt to accurately assess vulnerability. However, the impacts of climate change combined with high demand during tourist season may affect the ability of countries to adequately deal with seasonal demand for water in water-scarce regions. Total precipitation as well as temporal distribution, are taken into consideration when assessing climate change effects. Countries in the Caribbean typically experience two distinct seasonal climatic types that can be classified as the rainy or wet season (around January to May) and the dry seasons (around June to December).

Climate change can present additional water management problems. Such problems may arise from increased flooding, impeded drainage and elevated water tables. It is projected that on Andros Island in the Bahamas, where the water table is only 30 cm below the surface, high evaporation rates and increasing brackishness will eventuate with continued sea level rise.[4] For many small islands, saline intrusion into the freshwater lens would be of great concern, especially where

[1]El Niño - Southern Oscillation (ENSO) phenomenon is a global event arising from large-scale interaction between the ocean and the atmosphere. The Southern Oscillation, a more recent discovery, refers to an oscillation in the surface pressure (atmospheric mass) between the southeastern tropical Pacific and the Australian-Indonesian regions. When the waters of the eastern Pacific are abnormally warm (an El Niño event) sea level pressure drops in the eastern Pacific and rises in the west. The reduction in the pressure gradient is accompanied by a weakening of the low-latitude easterly trades.

[2]Snedaker, 1993, Vicente *et al*, 1993.

[3]Bacon, 1989.

[4]Lugo and Snedaker, 1974.

over-pumping of aquifers is already occurring (e.g., Barbados and the Bahamas). This would further diminish the amount of freshwater available for domestic and economic activity.

Studies have shown a decrease in precipitation in the tropics and sub-tropics. Current climate change-induced models simulate an increase in most equatorial regions but a general decrease in subtropics. Potential changes in intense rainfall frequency are difficult to infer from GCMs largely as a result of coarse spatial resolution, however there are indications that the frequency of heavy rainfall events and consequent flooding is likely to increase as a result of global warming. All water-related infrastructure can be directly damaged from severe weather events, and decreased water availability has implications for health, sanitation, and agriculture. These impacts are expected to be country-specific as various factors will influence the possible effects.

Although comprehensive watershed management programmes have been developed for some Caribbean countries, there is a need to undertake an inventory of all water resources to better assess and quantify likely impacts arising from climate change.

Food and Nutrition: Agriculture and Fisheries

One of the sectors most vulnerable to climate change is agriculture, and hence food security in the Caribbean is a pressing concern. This sector is of considerable importance to many economies in the region. While the full extent of impacts on this sector are yet to be assessed and quantified, it is expected that climate change will impact food production by reducing yields and thereby affecting food security, and exacerbating other problems associated with this sector, namely soil erosion, land degradation and soil fertility loss. Soil salinisation will also result in crop failure and reduced arable land acreage. Further work will be undertaken to understand the impacts of climate change on the agricultural sector so that appropriate intervention options can be developed.

Evidence of climate change can be found as persons directly involved in agricultural production have reported that certain pests remain active outside of their typical season and there is an apparent change in temporal distribution of rainfall (i.e., change in length of wet or dry seasons).

A direct impact of rising sea levels will be inundation and the threat of saline intrusion into cultivation fields. Drainage during the rain seasons may require additional and more intensive pumping facilities. The possible intrusion of salt water into the water conservancies and estuaries needs to be examined since these are the prime sources of irrigation water.

If weather systems become more intense, then the effect of flooding conditions must be addressed. More frequent El Niño/La Niña events can subject the coast to cycles of drought/flood which can have serious effects on the soil and, therefore, on food production. Cattle and other livestock may not be spared because of the severity of the conditions associated with these rainfall extremes. Apart from the effect on rice and sugar, scarcities of cash crops will be a problem and an economic hindrance.

The state of the fisheries is intimately linked to the health and resilience of the coastal ecosystems. A coral reef showing signs of degradation due to pollution will not support a healthy fishery. The clearance of mangroves removes important nursery areas of many commercially valuable species, which may consequently not survive to see adulthood.

Fish kills in Guyana, Grenada, St. Lucia, St. Vincent and the Grenadines, Barbados and Trinidad and Tobago in 1999 have been linked to the influx of nutrient rich algae from the Orinoco River into the Caribbean Sea, causing low oxygen content and the consequent proliferation of deadly bacteria. Caribbean scientists also confirmed that the water temperatures were significantly higher that normal. Projected climate change induced flooding and increased ocean temperatures can be expected to result in increased fish kills of this nature.

Housing, Settlement and Infrastructure

Most settlements in the Caribbean are located in the coastal regions, as this is also the location of much social and economic activity. Pre-existing

[18]Lugo and Snedaker, 1974.

[19]Martin and Bruce, 1999

conditions where coastal development has been approved without consideration of prudent coastal zone management, and decaying sea defense structures, make these areas all the more vulnerable to sea level rise and storm surges.

In 1999, the storm surges alone from Hurricane Lenny resulted in the devastation of a significant portion of coastal infrastructure all over the region. Jetties and other facilities were destroyed and houses were washed into the sea. With currently projected rates of sea level rise and flooding, coupled with the possibility of more intense and frequent extreme events such as cyclones (hurricanes) and associated storm surge, critical infrastructure such as social services, airports, port facilities, roads, coastal protection structures, tourism facilities and vital utilities will be at severe risk. Storm surges and sea level rise can result in the dislocation of coastal populations and will cause permanent inundation of the entire coastline in some areas if no response measures are taken.

Tourism

Tourism is the main foreign exchange earner in the region and the chief contributor to GNP for most countries. This sector also makes a significant contribution to employment, as for example in the Bahamas where tourism provides jobs for 70% of the country's labour force in 1998.

Climate change impacts will affect this industry both directly and indirectly. Sea level rise, storm surges and hurricane activity can result in lost beaches, inundation and degradation of coastal ecosystems and infrastructure. Saline intrusion can affect water supplies thereby reducing the supply of water for domestic, commercial and agricultural purposes. The loss of coral reefs and the biodiversity they support may also have a negative effect on tourism.

A significant proportion of tourist arrivals in the Caribbean occur during the winter months as visitors from the Northern Hemisphere (the largest market) attempt to escape cold winters. Projected global warming may mean milder winters and thus reduce the appeal of the Caribbean as a transit destination. It is projected that tourism can be further harmed by increased airfares if airlines are heavily taxed for greenhouse gas emissions.

To ensure sustainability of the industry, some countries have already invested quite heavily in reinforcing infrastructure and in sound coastal zone management practices, including setback and waste disposal regulations.

Human Health

This sector possibly has the least information in the region as it relates to climate change impacts. Perhaps impacts are too subtle, hence extensive research is not seen as a priority. The Caribbean has a favourable climate for many disease vectors. Therefore, climate-related chronic, contagious, allergic, and vector-borne diseases (e.g., malaria and dengue fever, asthma and hay fever), linked to plants or fungi whose ranges and life cycles are strongly affected by climate and weather can be expected to increase with global warming.

Cuba has done extensive work on climate change impacts on health. Their national climate change committee, working in conjunction with the Ministry responsible for Health, has the authority to issue warnings to the country when they expect/ suspect that there is danger of increased respiratory disorders associated with El Niño events. Their work on health also includes skin disorders resulting from over exposure to solar radiation.

At the southern end of the region, while there is a lack of data in Guyana, there have been reports that skin cancer is on the rise in a region of Guyana inhabited mostly by Amerindians (region 9). This report seems to suggest that Amerindians, who are repeatedly exposed to solar radiation, are being affected by higher incidences of UV-b radiation and possibly higher surface temperatures.

Climate-induced effects on other sectors such as agriculture, fisheries, water and coastal resources, and social and economic conditions might also affect human health. Decreases in food production might result in poorer diets, and rise in sea level and changed precipitation patterns may result in the deterioration of water supplies resulting in contamination. Greater numbers of humans could migrate from one area to another, changing the geographic ranges and susceptibility of human populations to many diseases. In general, any event that reduces standards of living will have an adverse impact on human health.

Recent global studies have focused on the possible impact that changing climate, season, and weather variables might have on the incidence of disease. Clear links have not yet been established between climate change and human health. The more subtle impacts on health may not be readily discernible by the public, thereby making it difficult to mobilize public support for policy changes that may be required.

Forestry and Terrestrial Biodiversity

The Caribbean has a highly variable incidence of biological diversity, which is already threatened by anthropogenic stresses: human consumption of natural resources and conversion of natural habitats to other purposes; ever increasing populations that result in the encroachment of agricultural and other cultural activities into natural ecosystems, making it difficult for these systems to adapt by moving with natural climate variability; and reduced resilience of many species whose numbers have been significantly reduced by hunting or harvesting.

Forest biodiversity in the Caribbean is very sensitive to changes in climate patterns. The removal of indigenous species by development activities or human settlement has caused micro-climates in cleared areas. These micro-climates are impacted by changing weather patterns and it is anticipated that exotic species must be introduced to re-forest such areas. Impacts of climate change on some species will result from physiological stress due to loss of habitats.

Increased levels of carbon dioxide in the atmosphere will be beneficial for some plant species but the overall effect will be negative. Other impacts are direct loss of forest cover and other habitats as well as many animal species due to heat stress or storm activity.

Other Economic and Socio-cultural Impacts

Climate change could have direct and indirect impacts on other sectors in the Caribbean region. The insurance industry, for instance, is highly sensitive to the intensity and frequency of disasters – climate change-induced or not. Because insurance premiums are based on assessment of risk of occurrence of a particular event, any indication of an increase in hurricane and storm activity can mean that premiums will increase. Within the past decade the cost of insurance has increased considerably – which is not surprising when insurance companies have had to pay out billions of dollars for damage from hurricanes and other natural disasters which caused widespread socio-economic dislocation, injury and loss of life. In Antigua, following the passage of numerous hurricanes in the 1990's, the cost of insurance for many coastal properties has become prohibitive, with many owners opting not to insure at all. Even in cases where there was no damage in the insular Caribbean itself – as with hurricane Andrew that devastated Florida in 1992 – an increase in insurance premiums in the Caribbean subsequently occurred.

Certain traditional assets will also be at risk from climate change. These assets may include subsistence and traditional technologies (skills and knowledge), community structure and coastal villages and settlements.

ANNEX 6 "Model" Terms of Reference for Undertaking Detailed Vulnerability Assessment of Climate Change*

Vulnerability Assessment for Trinmar Base Relocation

1.0 Introduction

Petroleum Company of Trinidad and Tobago (PETROTRIN) proposes to relocate it's Trinmar Marine Base to the Mt. Pellier Estate which is 7 km south west of the existing site in Point Fortin. A Certificate of Environmental Clearance (CEC) is required from the Environmental Management Authority to proceed with this project. An Environmental Impact Assessment (EIA) is being conducted to fulfill the requirements of this CEC application and a Vulnerability Assessment of the proposed base facilities and operations to the impacts of sea level rise is to be conducted as an integral component of this EIA.

2.0 Outline of Works

For the proposed project and project site, the contractor will be required to undertake the following.

2.1 Identify and Evaluate Potential Impacts From Climate Change on the Project's Area of Influence.

In collaboration with project planners, consultants undertaking other aspects of baseline studies and Petrotrin EIA team, the contractor must assess the potential impacts of climate driven sea level rise on:

a) Marine Base's Infrastructure and Operations

b) Hydrology (surface and subsurface) of the Mt. Pellier estate

c) Biodiversity and wildlife of the Mt. Pellier estate

d) Ecosystems and their goods and services (agriculture, forestry, fisheries, aquaculture, coastal zones and marine ecosystems)

e) Soils and land resources

f) Human settlements

g) Human health

h) Socio-economic development.

2.2 Develop Sea Level and Temperature Rise Scenarios

Temperature and sea-level rise scenarios over an 70-year timeline must be developed with the use of general circulation models (A-OGCM) to illustrate the impacts of sea level rise on 2.1 a) and b). Preferred General Circulation models are CGCM 1 and HadCM3.

2.3 Mapping Sea Level Rise Scenarios

Topographic maps must be provided showing sea levels after 20, 50 and 80 years in the Mt. Pellier area with the proposed marine base and support infrastructure on site.

2.4 Develop Climate Change Adaptation Plan

Contractor must develop a Climate Change Adaptation Plan to address potential impacts of sea level rise on 2.1 a) to h). The EIA team, project planners, consultants undertaking baseline assessments and evaluations are to be consulted in developing this adaptation plan.

* courtesy of the Petroleum Company of Trinidad and Tobago (PETROTRIN)

2.5 Develop Climate Change Monitoring Program

Contractor must develop a climate change monitoring program. Such a program should be designed to monitor:

a) patterns of climate and coastal waters affecting the project area

b) climate change impacts on key social, economic and environmental indicators.

N.B. – WORKS MUST BE DONE IN ACCORDANCE WITH THE ACCC DRAFT GUIDELINES FOR INTEGRATING CLIMATE CHANGE ADAPTATION INTO THE ENVIORNMENTAL IMPACT ASESSMENT PROCESS.

ANNEX 7 Sample Terms of Reference (ToR) for EIA*

Definitions: "Environment" and "Environmental Impacts", as used in the report, are to include natural hazards (including climate change) and natural hazard impacts.

1. INTRODUCTION. This section should:

a) state the purpose and objectives of the EIA;
b) identify the development project to be assessed;
c) identify natural hazard and climate change elements that may affect the development project; and
d) explain the executing arrangements for the environmental assessment.

2. BACKGROUND INFORMATION. Pertinent background for the potential parties who may conduct the environmental assessment, whether they are consultants or government agencies, would include: a brief description of the major components of the proposed project, a statement of the need for it and the objectives it is intended to meet; the implementing agency; a brief history of the project (including alternatives considered), its current status and timetable; and the identities of any associated projects. If there are other projects in progress or planned within the zone of influence of the proposed project which may compete for or utilize the same natural resources, these should also be identified here.

3. OBJECTIVES. This section will summarise the general scope of the environmental assessment which shall be to assess:

a) the impacts of the proposed project on the environment; and
b) the impacts of natural hazards and climate change on the proposed project, and discuss its timing in relation to the processes of project preparation, appraisal and implementation.

4. ENVIRONMENTAL ASSESSMENT REQUIREMENTS. This section should identify any regulations and guidelines that will govern conduct of the assessment or specify the content of its report. These may include any or all of the following:

- national laws and/or regulations on environmental reviews and impact assessments; regional, parish/district
- environmental assessment regulations;
- environmental assessment regulations of any other financing organizations involved in the project; and
- applicable national or regional guides for the integration of natural hazard and climate change considerations into the EIA process.

5. STUDY AREA. Specify the:

a) spatial or geographic boundaries of the study area for the assessment (e.g. water catchment, air shed);
b) temporal boundaries for major project activities (design, construction, operation, decommissioning, abandonment); and
c) natural hazard or climate change elements affecting the spatial or temporal boundaries of the proposed project.

*Adapted from Caribbean Development Bank (CDB) EIA Guidelines

6. SCOPE OF WORK. In some cases, the tasks to be carried out by a consultant will be known with sufficient certainty to be specified completely in the TOR. In other cases, information deficiencies need to be alleviated,or specialized field studies or modeling activities performed to assess environmental, socio-economic, natural hazard and climate change impacts, and the consultant will be asked to define particular tasks in more detail for contracting agency review and approval. Task 4 in the Scope of Work is an example of the latter situation.

7. TASKS

Description of the Proposed Project. Provide a brief description of the relevant parts of the project, using maps (at appropriate scale) where necessary, and including the following information: location; general layout; size, capacity, any natural hazard or climate change element affecting the temporal or spatial boundaries of the proposed project, etc.; pre-construction activities; construction activities; schedule; staffing and support; facilities and services; operation and maintenance activities; required off-site investments; and life span.

Description of the Environment. Assemble, evaluate and present baseline data on the relevant environmental characteristics of the study area that are relevant to project siting or design, or to the formulation of mitigation measures. Include information on any changes anticipated before the project commences.

a) Physical environment: geology; topography; soils; climate and meteorology; air quality; surface and groundwater hydrology; coastal and oceanic parameters; existing sources of air emissions; existing water pollution discharges and receiving water quality; areas vulnerable to flooding, inundation, landslides, erosion and other impacts from natural hazards or climate change.

b) Biological environment: flora; fauna; rare or endangered species; sensitive habitats, including parks or preserves, significant natural sites, etc.; species of commercial importance; species with potential to become nuisances, vectors or dangerous; species or ecosystems vulnerable to natural hazard or climate change impacts.

c) Socio-cultural environment (include both present and projected where appropriate): population; land use; planned development activities; community structure; employment; distribution of income, goods and services; recreation; public health; cultural properties; tribal peoples; customs, aspirations and attitudes; socio-economic activities vulnerable to natural hazard or climate change impacts.

Description of the Vulnerability of the Project to Natural Hazards and Climate Change. Describe the vulnerability of the project to natural hazards and climate change impacts including the frequency, magnitude and distribution of any natural hazard or climate change element affecting the spatial or temporal boundaries of the proposed project. Assemble, evaluate and present baseline data on the relevant natural hazard/climate change characteristics of the study area that are relevant to project siting or design, or to the formulation of mitigation or adaptation measures. Include information on any changes anticipated before the project commences.

Legislative, Regulatory and Related Considerations. Describe the pertinent regulations and standards governing environmental quality, health and safety, protection of sensitive areas, protection of endangered species, siting, land use control, etc., at international, national, and where relevant at the local levels including relevant Multilateral Environmental Agreements (MEAs). (The TOR should specify those that are known and require the consultant to investigate for others).

Determination of (a) Potential Impacts of the Proposed Project; and (b) Impacts of Natural Hazards and Climate Change on the Proposed Project. In this analysis, distinguish between significant positive and negative impacts, direct and indirect impacts, cumulative impacts, and immediate and long-term impacts. Identify impacts which are unavoidable or irreversible. Wherever possible, describe impacts quantitatively, in terms of social/environmental

costs and benefits. The analysis of potential impacts of the proposed project is to include an assessment of potential exacerbations or reduction of natural hazard impacts, both on- and off-site. Characterise the extent and quality of available data, explaining significant information deficiencies and any uncertainties associated with predictions of impact. If possible, give the TOR for studies to obtain the missing information. (Identify the types of special studies likely to be needed for this project category.)

Analysis of (a) Feasible Alternatives to the Proposed Project, and (b) Feasible Mitigation and Adaptation Plans to address significant impacts frtom Natureal Hazards and Climate Change. Describe feasible alternatives and feasible mitigation and adaptation plans that were examined in the course of developing the proposed project and identify other alternatives which would achieve the same objectives. Alternatives considered must address natural hazard impacts that have been identified. The concept of alternatives extends to siting, design, technology selection, construction techniques and phasing, and operating and maintenance procedures. Compare alternatives in terms of potential environmental impacts; capital and operating costs; suitability under local conditions; and institutional, training and monitoring requirements. When describing the impacts, indicate which are irreversible or unavoidable and which can be mitigated, managed or addressed under an appropriate climate change adaptation plan. To the extent possible, quantify the costs and benefits of each alternative, incorporating the estimated costs of any associated mitigation/adaptation measures. Include the alternative of not constructing the project, in order to demonstrate environmental conditions without it.

Development of Management, Mitigation and Adaptation Plan to Address Negative Impacts. Recommend feasible and cost-effective measures to prevent or reduce significant negative impacts to acceptable levels. Estimate the impacts and costs of those measures, and of the institutional and training requirements to implement them. Consider compensation to affected parties for impacts which cannot be mitigated, managed or addressed under an appropriate adaptation plan.. Prepare a management plan including proposed work programmes, budget estimates, schedules, staffing and training requirements, and other necessary support services to implement the mitigating measures.

Identification of Institutional Needs to Implement Environmental Assessment Recommendations. Review the authority and capability of institutions at the local and national levels and recommend steps to strengthen or expand these so that the management, mitigation and adaptation plans and any monitoring program in the environmental assessment can be implemented. The recommendations may extend to new laws and regulations, new agencies or agency functions, intersectoral arrangements, management procedures and training, staffing, operation and maintenance training, budgeting, and financial support. The role of Climate Change Focal Points and National Disaster Management Agencies involved in the review of any environmental assessment and in any monitoring and evaluation should be outlined.

Development of a Monitoring Plan. Prepare a detailed plan to monitor the implementation of management, mitigation or adaptation measures and the impacts of (a) the project during construction and operation, and (b) climate change during all phases of the project (design, construction, operation, abandonment and decommissioning). Include in the plan an estimate of capital and operating costs and a description of other inputs (such as training and institutional strategy).

Assist in Inter-Agency Coordination and Public/NGO Participation. Assist in coordinating the environmental assessment with other government agencies, in obtaining the views of local NGOs and affected groups, and in keeping records of meetings and other activities, communications, and comments and their disposition. Describe the process and procedures whereby hazard maps, climate change scenarios were made available for the public consultation process. (The TOR should specify the types of activities; e.g., inter-agency scoping session, environmental briefings for project staff and inter-agency committees, support to environmental advisory panels, public forum.)

8. Report. The environmental assessment report should be concise and limited to significant environmental, natural hazard and climate change issues. The main text should focus on findings, conclusions and recommended actions, supported by summaries of the data collected and citations for any references used in interpreting those data. Detailed or uninterpreted data are not appropriate in the main text and should be presented in appendices or a separate volume. Unpublished documents used in the assessment may not be readily available and should also be assembled in an appendix. Organise the environmental assessment report according to the outline below.

a) Executive Summary;

b) Policy, Legal and Administrative Framework;

c) Description of the Proposed Project including overall goals and objectives;

d) Description of the Environment including natural hazards and climate change;

e) Significant Environmental, Natural Hazard and Climate Change Impacts;

f) Analysis of Alternatives;

g) Management, Mitigation and Adaptation Plan;

h) Environmental Management and Training;

i) Monitoring Plan including for Natural Hazards and Climate Change;

j) Inter-Agency and Public/NGO Involvement;

k) List of References; and

l) Appendices:
   - i) List of Environmental Assessment Preparers;
   - ii) Records of Inter-Agency and Public/NGO Communications; and
   - iii) Date and Unpublished Reference Documents.

9. CONSULTING TEAM. Environmental assessment requires interdisciplinary analysis. Identify in this paragraph which specializations ought to be included on the team for the particular project category. Team should include members trained in the integration of natural hazards/climate change into the EIA process.

10. SCHEDULE. Specify dates for inception report, progress reviews, interim and final reports, and other significant milestones.

11. OTHER INFORMATION. Include here lists of data sources, project background reports and studies, relevant publications, and other items to which the consultant's attention should be directed, including climate change scenarios, climate impact data, and vulnerability maps.

ANNEX 8 Sample Project Appraisal/Review Checklist

This document is an excerpt from the Draft EIA Report Review Manual, produced by the Jamaica National Environment and Planning Agency (NEPA), 10-11 Caledonia Avenue, Kingston 5, Jamaica; December 2003.

1	**DESCRIPTION OF THE DEVELOPMENT, THE LOCAL ENVIRONMENT AND THE BASELINE CONDITIONS**
1.1	**Policy, Legal and Administrative Framework: The adherence to national policies and legislation where necessary should be clearly outlined in the report.**
1.1.1	The regulations, standards, policies and guidelines applicable to project should be referred to and reference to those applicable made in the report. The terms of reference for the environmental impact assessment should be included and made available.
1.2	**Description of the development: The purpose of the development should be described as should the physical characteristics, scale, design and where appropriate a description of the production process should be included.**
1.2.1	The purposes and objectives of the development should be explained.
1.2.2	The design and size of the development should be described including diagrams, plans or maps.
1.2.3	The nature of the production processes intended to be employed in the completed development should be described with the appropriate layouts and the expected rate of production outlined.
1.3	**Baseline conditions: A description of the affected environment as it is currently and as it could be expected to develop should be presented.**
1.3.1	Local land use plans, guidelines and policies should be consulted and the other data collected to assist in the determination of the baseline conditions (biological and social) i.e., the probable future state of the environment in the absence of the project, taking into account natural and man-induced fluctuations and human activities.
1.3.2	From this information a description of the project without the proposed development must be documented in the report.
1.3.3	Include historical background in terms of climate conditions, and anticipated climate change scenarios and impacts affecting the area of the proposed development.
1.4	**Environment description: The area and location of the environment likely to be affected by the development proposals should be described. (See Appendix 5 for a list of factors that the developer should consider when describing the environment.)**
1.4.1	The environment expected to be affected by the development should be indicated with the aid of a suitable map of the area – for example does the study area fall within a Conservation Area/ Protected Area/ vulnerable area. Include hazard and/or vulnerability maps.

1.4.2 The affected environment should be defined broadly enough to include any potentially significant effects occurring away from the immediate construction site. For example the dispersion of pollutants, etc.

1.4.3 The boundaries of the development site should be defined and its location clearly shown on a map.

1.4.4 The uses to which this land will be put should be described and the different land use areas demarcated.

1.4.5 The duration of construction, operational and where appropriate, decommission phase should be estimated. Climate change impacts should be determined for each phase of the project.

1.5 Wastes:* The types and quantities of wastes which might be produced should be estimated, and the proposed disposal routes to the environment described, including a description of the vulnerability of the proposed route to natural hazards associated with climate change.
(*Wastes include all residual process materials, effluents and emissions.)

1.5.1 The types and quantities of waste matter, and there residual material and the rate at which these will be produced should be estimated.

1.5.2 The ways which it proposed to treat these wastes and residuals should be indicated, together with the routes by which they will eventually be disposed of to the environment. If waste is to be recycled the process should be outlined in the report.

2 IDENTIFICATION AND EVALUATION OF KEY ENVIRONMENTAL (INCLUDING CLIMATE CHANGE) & SOCIO-ECONOMIC IMPACTS

2.1 Identification of Environmental Impacts: Methods should be used which are capable of identifying all significant impacts of the project on the environment and identifying significant impacts on the project from climate change.

2.1.1 Impacts (including climate change impacts) should be identified using a systematic methodology such as a matrix, consultations etc.

2.1.2 A brief description of the impact (including climate change impacts) identification method should be given, as should the rationale for using them.

2.2 Definition of environmental impacts: Potential impacts of the development on the environment as well as the potential impact from climate change on the development should be investigated and described. Impacts should be broadly defined to cover all potential effects on the environment, and all potential climate change impacts on the development and surrounding area.

2.2.1 An exhaustive list/matrix should be compiled including all:

i) the direct effects and any indirect, cumulative, short, medium and long-term permanent and temporary, positive and negative effects of the project, and

ii) the direct climate change impacts and any indirect, cumulative, short, medium and long-term permanent and temporary, positive and negative impacts from climate change on the project.

2.2.2 The above types of effects should be investigated and described with particular regard to identifying effects on or affecting biodiversity, soil, water, air, climate landscape, material assets, human health risk and the interactions between these.

2.3 Assessment of socio-economic and environmental impact significance: The expected significance that the projected impacts will have for society and the environment should be estimated. The climate change models used for the assessment should be identified. The sources of quality standards, together with the rationale, assumptions and value judgments used in assessing significance should be fully described.

2.3.1 The significance of an impact should be assessed, taking into consideration national and international quality standards where available.

2.3.2 Where mitigating or climate change adaptation measures for impacts have been proposed, the significance of any impact remaining after mitigation or appropriate adaptation measures should be described.

2.4 Prediction of environmental impact (including climate change impacts) magnitude: The likely impacts of: (a) the development on the environment; and (b) climate change on the development, should be described in exact terms wherever possible.

2.4.1 The magnitude of the predicted impact should be identified. Where possible predictions of impacts should be expressed in measurable quantities with ranges and or confidence limits as appropriate.

2.4.2 The methods used to predict magnitude should be described and be appropriate to the size and importance of the projected impact.

2.5 Definition and identification of potential socio-economic impacts: The effect of the development on the socio-economic characteristics of the project area should be investigated and described. This should also include the prediction of impacts that the project will have on the socio-economic characteristics of the area to be developed and the extent to which this may be affected by climate change impacts.

2.5.1 The socio-economic characteristics of the existing location should be identified.

2.5.2 The impacts of: (a) the proposed project; and (b) climate change, on the socio-economic environment should be analyzed including the use of land, the main economic activities (tourism etc.), and the social level within nearby communities, employment levels and existence of archaeological and historical sties.

2.5.3 These impacts should be categorized in terms of being positive or negative

3 ALTERNATIVES

3.1 Alternatives: Feasible alternatives to the proposed project should have been considered. These should be outlined in the Report, the socio-economic and environmental implications of each presented, and the reasons for their rejection briefly discussed, particularly where the preferred project is likely to have significant adverse environmental impacts or is likely to be severely compromised by prevailing and projected environmental issues.

3.1.1 Alternative sites should have been considered where these are practicable, available and cost-effective to the developer. The main environmental advantages and disadvantages of these should be discussed and the reasons for the final choice given.

3.1.2 Where available, alternative processes, designs and operating conditions should have been considered at an early stage of the project planning and the socio-economic and environmental implications of these investigated and reported where the proposed project is likely to have significant adverse environmental impacts.

3.1.3 The analysis of alternatives should include the "no-action" alternative.

4 MITIGATION AND ADAPTATION

4.1 Mitigation Measures: All significant adverse impacts of the project on the environment and vice versa should be considered for mitigation. Evidence should be presented to show that proposed mitigation measures will be effective when implemented.

4.1.1 The mitigation of all significant adverse impacts should be considered and where practicable, specific mitigation measures should be put forward. The cost of the mitigation action should be assessed and included in the Report.

4.1.2 It should be clear to what extent mitigation methods will be effective when implemented. Where the effectiveness is uncertain or depends on assumptions about operating procedures, climatic conditions etc., data should be introduced to justify the acceptance of these assumptions.

4.1.3 Any unmitigated impacts should be indicated and justification offered as to why these impacts were not mitigated for.

4.1.4 In the case of beneficial impacts it should be demonstrated how these can be maximized.

4.2 Commitment to mitigation: developers should be committed to, and capable of, carrying out the mitigation measure and should present plans of how they propose to do so.

4.2.1 There should be a clear record of the commitment of the developer to the mitigation measures presented in the Report. Details of how the mitigation measures will be implemented and function over the time span for which they are necessary should be given.

4.3 Adaptation measures: All significant climate change impacts affecting the project should be considered in the formulation of appropriate adaptation measures. Evidence should be presented to show that proposed adaptation measures are consistent with any adaptation policy or program being implemented at the national level, and will be effective when implemented.

4.3.1 The implementation of appropriate adaptation measures to address all significant adverse impacts should be considered and where practicable, specific adaptation measures should be put forward. The cost of the adaptation measures should be assessed and included in the Report.

4.3.2 It should be clear to what extent adaptation measures will be effective when implemented. Where the effectiveness is uncertain or depends on assumptions about operating procedures, climatic conditions etc., data should be introduced to justify the acceptance of these assumptions.

4.3.3 Any significant climate change impacts that cannot be adequately addressed through appropriate adaptation measures should be indicated and justification offered as to why suitable adaptation measures were not provided for these impacts.

4.3.4 In the case of beneficial impacts it should be demonstrated how these can be maximized.

4.3.5. Commitment to adaptation: developers should be committed to, and capable of carrying out the proposed adaptation measure and should present plans of how they propose to do so.

4.3.6 There should be a clear record of the commitment of the developer to the adaptation measures presented in the Report. Details of how the adaptation measures will be implemented and function over the time span for which they are necessary should be given.

5 MONITORING

5.1 Monitoring programme: Developers should include a detailed monitoring plan and present how they intend to implement this plan.

5.1.2 A detailed environmental and climate change monitoring plan should be described outlining the reasons for the costs associated with the monitoring activities.

5.1.3 The plan should clearly state the institutional arrangements for carrying out the work, the parameters to be monitored, methods employed, standards or guidelines to be used, evaluation of results, schedule and duration of monitoring, initiation of action necessary to limit adverse impacts disclosed by monitoring, format and frequency of reporting.

5.2 Environmental management and training: Developers should include a detailed management plan for all stages of the development.

5.2.1 The developer should include a detailed management plan outlining how the environment and any significant impacts from climate change will be managed or addressed during the implementation of both the construction and operational phases of the project.

5.2.2 The training programme for employees of the facility should be outlined.

5.2.3 The plan should also include any institutional needs for implementing the recommendations of the EIA report.

6 PUBLIC / COMMUNITY INVOLVEMENT

6.1 The public should be actively involved in the EIA process using appropriate methods of garnering public opinion, including local knowledge of past events. The public should be provided with full information concerning any anticipated climate change impacts affecting the development.
(See Appendix 7 for various public consultation methods that may be employed.)

6.1.1 Where applicable, the Non-Governmental Organisations (NGOs) and citizens within the community in which the project is proposed to be implemented should be formally contacted in writing and be informed of the project. Comments should be sought from all parties who will be affected by the proposed action.

6.1.2 The methods employed to obtain public/community input should be described and assessed for appropriateness depending on size of audience, expertise required and issues and concerns should be documented in accordance with the guidelines for Public Participation.

7 COMMUNICATION OF RESULTS

7.1 Layout: The layout of the Report should enable the reader to find and assimilate data easily and quickly. External data sources should be acknowledged.

7.1.1 There should be an introduction briefly describing the project, the aims of the environmental assessment and how these aims are to be achieved.

7.1.2 Information should be logically arranged in sections or chapters and the whereabouts of important data should be signaled in a table of contents or index.

7.1.3 Unless the chapters themselves are short, there should be chapter summaries outlining the main findings of each phase of the investigation.

7.1.4 When data, conclusions or quality standards from external sources are introduced, the original source should be acknowledged at that point in the text. Full reference should also be included either with the acknowledgment, at the bottom of the page or in a list of references.

7.1.5 Where climate change models and scenarios are used, the source of such models and scenarios should be identified. The risk management regime used to address any scientific uncertainty should be identified.

7.2 Presentation: Care should be taken in the presentation of information to make sure that it is accessible to the non-specialist.

7.2.1 Information should be presented so as to be comprehensible to the non-specialist. Tables, graphs and other devices should be used as appropriate. Unnecessary technical or obscure language should be avoided.

7.2.2 Technical terms acronyms and initials should be defined, either when first introduced into the text or in a glossary.

7. 3. Emphasis: Information should be presented without bias and receive the emphasis appropriate to its importance in the context of the environmental report.

7.3.1 Prominence and emphasis should be given to potentially severe adverse impacts as well as to potentially substantial favourable environmental and climate change impacts.

7.3.2 The Report should be unbiased. Adverse impacts should not be disguised by euphemisms or platitudes.

7.4 Executive Summary: There should be a clearly written executive summary of the main findings of the study and how they were reached.

7.4.1 There should be an executive summary of the main findings and conclusion of the study. Technical terms, lists of data and detailed explanations of scientific reasoning should be avoided.

7.4.2 The summary should cover all main issues discussed in the Report and contain at least a brief description of the project and the environment, a brief summary of anticipated significant climate change impacts affecting the development, an account of the main mitigation and adaptation measures to be undertaken by the developer and a description of any significant residual impacts.

7.4.3 A brief explanation of the method by which these data were obtained and an indication of the confidence which can be placed in them should also be included.

ANNEX 9 References and Further Reading

Asian Development Bank (ADB). (2003) "Cumulative Effects Assessment in Environmental Assessment." *Environmental Assessment Guidelines*.

Biliana Cicin-Sain. February 1997. *Guidelines for Integrating Coastal Management Programs and National Climate Change Action Plans*.

Canadian Environmental Assessment Agency. (1999) *Cumulative Effects Assessment Practitioners Guide.*

CARICOM. (2003) *Caribbean Risk Management Techniques for Climate Change.*

D.F. Oderson. (2003) *Review of Environmental Impact Assessment (EIA) Procedures in CARICOM States Participating in the Adapting to Climate Change in the Caribbean (ACCC) Project*.

Government of Barbados. (1998) *Environmental Impact Assessment Guidelines and Procedures for Barbados.*

Government of Jamaica. (1998) *Guidelines for Conducting Environmental Impact Assessments.* Natural Resources Conservation Authority.

Government of Trinidad and Tobago (2001) *A Guide to the Application for a Certificate of Environmental Clearance*. Environmental Management Authority (EMA).

Government of Trinidad and Tobago. (2001) *CEC Review Manual.* Environmental Management Authority (EMA).

Inter American Development Bank (IADB). (2001) *Review of Environmental Impact Assessment in Selected Countries of Latin-America and the Caribbean.*

Intergovernmental Panel on Climate Change (IPCC). 2001. *Climate Change 2001 - Impacts, Adaptation and Vulnerability*. WMO/UNEP.

Intergovernmental Panel on Climate Change Response Strategies Working Group (Coastal Zone Management Subgroup). March 1992. *Global Climate Change and the Rising Challenge of the Sea.*

Intergovernmental Panel on Climate Change (IPCC). 1994. *IPCC Technical Guidelines for Assessing Climate Change Impact and Adaptations.*

Intergovernmental Panel on Climate Change (IPCC). June 1990. *Policymakers Summary of the Formulation of Response Strategies.*

Intergovernmental Panel on Climate Change (IPCC). April 1994. *Preparing to Meet the Coastal Challenges of the 21st Century.*

Intergovernmental Panel on Climate Change (IPCC). 1998. *Regional Impacts of Climate Change: An Assessment of Vulnerability.*

Intergovernmental Panel on Climate Change. 2000. *Special Report on Emission Scenarios,* Nakicenovic, N., et al., Cambridge University Press 599 pp.

Intergovernmental Panel on Climate Change, 2001. Volume I, *Third Assessment Report: The Scientific Basis,* Houghton, J.T. et al., ed. Cambridge University Press, 867 pp.

National Centre for Environmental Assessment, United States Environment Protection Agency. (2003) *Framework for Cumulative Risk Assessment.*

R.J. Nicholls, S.P. Leatherman, K.C. Dennis, C.R. Volonte. 1995. "Impacts and Responses to Sea-level Rise: Qualitative and Quantitative Assessments." *Journal of Coastal Research*. SI. 14. 26-43. 1995.

Roger A. Pielke. (1998) "*Rethinking the Role of Adaptation in Climate Policy*." *Global Environmental Change*. Vol. 8. No. 2., P.159.

Samuel Fankhauser, Joel B. Smith, Richard S. Tol. (1999) "Weathering Climate Change: Some Simple Rules to Guide Adaptation Decisions." *Ecological Economics* 30, 67-68.

Thomas Downing. September 1999. *Confidence and Speculation in the Assessment of Climate Change Impacts*. Paper Presented to the UNFCCC Workshop on Articles 4.8 and 4.9. of the Framework Convention on Climate Change.

United Nations Environment Programme (UNEP). October 1996. *Handbook on Methods for Climate Change Impact Assessment and Adaptation Strategies.*

UNFCC Secretariat. May 1999. *Compendium of Decision Tools to Evaluate Strategies for Adaptation to Climate Change.*

University of the West Indies. (May 2003) *Environmental Impact Assessment*. Master's Program in Natural Resource Management Course Material.

World Bank Environment Division. January 1999. *Environmental Assessment*. (OP 4.01).

World Bank Environment Division. January 1999. *Environmental Assessment (Guidelines)*. (BP 4.01).

World Bank Environment Department. July 1991. *Environmental Assessment Sourcebook. Volume I - Policies, Procedures, and Cross-Sectoral Issues.*

World Bank Environment Division. December 1997. *Environmental Hazard and Risk Assessment. Environmental Assessment Sourcebook Update.*

World Bank Environment Department. March 1995. *The World Bank and the UN Framework Convention on Climate Change*. ESSD/World Bank.