CGCED

CARIBBEAN GROUP FOR COOPERATION
IN ECONOMIC DEVELOPMENT

NATURAL HAZARD RISK MANAGEMENT IN THE CARIBBEAN: REVISITING THE CHALLENGE

DISCUSSION
DRAFT

Caribbean Country Management Unit
Latin America and the Caribbean Region
The World Bank

This paper was prepared under the auspices of the Caribbean Group of Cooperation in Economic Development (CGCED). Established in 1977, the CGCED has evolved into a forum for policy dialogue and aid coordination among the Caribbean countries, international financial institutions, bilateral donors, non-governmental organizations, and private sector enterprises. A meeting of the CGCED has been held every two years in Washington, DC and chaired by the World Bank. In addition to country strategy papers, the following studies have been prepared for the 2002 meeting

Caribbean Economic Overview 2002: Macroeconomic Volatility, Household Vulnerability, and Institutional and Policy Responses
(World Bank)

Implementation of the Caribbean Single Market and Economy
(Messrs. Brewster, Dolan, and Stewart)

Development Assistance and Economic Development in the Caribbean Region: Is There a Correlation?
(World Bank)

Natural Hazard Risk Management in the Caribbean: Revisiting the Challenge
Natural Hazard Risk Management in the Caribbean: Good Practices and Country Case Studies (Technical Annex)
(World Bank)

Youth Development in the Caribbean
(World Bank)

NATURAL HAZARD RISK MANAGEMENT IN THE CARIBBEAN: REVISITING THE CHALLENGE

Report No. 24166-LAC

June 2002

Caribbean Country Management Unit
Latin America and the Caribbean Region
The World Bank

NATURAL HAZARD RISK MANAGEMENT IN THE CARIBBEAN: REVISITING THE CHALLENGE

TABLE OF CONTENTS

Acknowledgements

This report was prepared by a team headed by Arnaud M. Guinard, Lead Urban Specialist of the Urban Unit in the Latin America and the Caribbean Regional Office of the World Bank. The core technical team members were Oliver Davidson, Disaster Management Consultant, John D. Pollner, Lead Financial Sector Specialist, LCSFS, and Jan Vermeiren, Chief Caribbean Division and Principal Specialist, and Steven Stichter, Natrural Hazard Specialist , both of the Unit for Sustainable Development and Environment at the Organization of American States. Eugene McCarthy participated in the drafting of the report and Homa-Zahra Fotouhi provided valuable editorial support.

The Country Director for this work was Orsalia Kalantzopoulos, World Bank; the Sector Director, Danny Leipziger; and the Sector Manager, Maria Emilia Freire.

The report could not have been produced without the valuable contribution of technical experts in the region who conducted the case studies of risk management practices. They were Peter Adrien, Tony Gibbs, Christine Herridge, Cedric Stephens and Deborah Thomas. Their work was made possible thanks to the inputs and comments received from many officials and individual specialists in each country and whose names are indicated in the Technical Annex .

We also wish to thank the participants of the regional consultation meeting held in Kingston, Jamaica on March 25-26, 2002. Present at the meeting were: Oliver Davidson, Consultant, World Bank, Arnaud Guinard, World Bank, Eleanor Jones, Environmental Solutions, Jamaica, Ambassador Mosina Jordan, USAID-Jamaica, Franklin McDonald, NEPA, Jamaica, Bartholomew Nyarko-Mensah, UNDP-Barbados, Elizabeth Riley, CDERA, Cassandra Rogers, CDB-DMFC, Paul Saunders, ODPEM, Jamaica, Joyce Thomas, NERO, Grenada, Steven Stichter, OAS/USDE and Jennifer Worrell, USAID-OFDA/LAC.

Financial contribution was received from the Bank Netherlands Partnership Program (BNPP) to carry out technical work on individual case studies and the regional consultation process.

ABBREVIATIONS AND ACRONYMS

ADMD	Asociación Dominicana de Mitigación de Desastres
BVI	British Virgin Islands
CARDIN	Caribbean Disaster Information Network
CARICOM	Caribbean Community
CARILEC	Caribbean Electric Utility Association
CAST	CHA Caribbean Alliance for Sustainable Tourism
CDB	Caribbean Development Bank
CDERA	Caribbean Disaster Emergency Response Agency
CDM	Comprehensive Disaster Management
CDMP	USAID/OAS Caribbean Disaster Mitigation Project
CGCED	Caribbean Group for Cooperation in Economic Development
CHA	Caribbean Hotel Association
CIDA	Canadian International Development Agency
CLAA	Caribbean Latin American Action
COSALC	Coast and beach stability in the Caribbean
CRID	Disaster Information Center for Latin America and the Caribbean
CTO	Caribbean Tourism Organization
CUBiC	Caribbean Uniform Building Code
DMFC	Disaster Mitigation Facility for the Caribbean (at the CDB)
ECCB	Eastern Caribbean Central Bank
ECHO	European Community Humanitarian Office
ECLAC	Economic Commission for Latin America and the Caribbean
EIA	Environmental Impact Assessment
GDP	Gross Domestic Product
GIS	Geographic Information System
IAC	Insurance Association of the Caribbean
IDB	Inter-American Development Bank
MACC	Mainstreaming Adaptation to Climate Change
NDO	National Disaster Office
NEPA	Jamaica National Environment and Planning Agency
NGO	Non-Governmental Organization
NHIA	Natural Hazard Impact Assessment
NRMU	OECS Natural Resources Management Unit
OAS	Organization of American States
OECS	Organization of Eastern Caribbean States
PADF	Pan American Development Foundation
PAHO	Pan American Health Organization
PGDM	USAID/OAS Post-Georges Disaster Mitigation Project
SRU	Seismic Research Unit of the University of the West Indies
UNCHS	United Nations Centre for Human Settlements
UNDP	United Nations Development Programme
UNFAO	United Nations Food and Agriculture Organization
USAID	U. S. Agency for International Development
UTech	University of Technology (Jamaica)
UWI	University of the West Indies

NATURAL HAZARD RISK MANAGEMENT IN THE CARIBBEAN: REVISITING THE CHALLENGE

EXECUTIVE SUMMARY

1. Natural Disasters —A Development Challenge

- The consequences of natural disasters for economic activities, property, human welfare and natural resources can be devastating. In the Caribbean, these events have greatly affected the productive sectors of the economy such as agriculture and tourism, not to mention the impact on communities, in particular the poor. On average, at least one major hurricane and numerous tropical storms cross the Caribbean each year. Within the Caribbean region, individual countries have incurred losses from a single hurricane event exceeding annual GDP. Climate change is likely to make matters worse. Extreme weather events may occur more frequently, sea-level rise would magnify the impact of storm surge and waves on coastal areas, while protective eco-systems like coral reefs and mangroves would be weakened by increased sea-surface temperatures and changes in salinity.

- With increasing frequency, countries in the region are facing situations in which scarce resources that were earmarked for development projects have to be diverted to relief and reconstruction following disasters, thus setting back economic growth. Recent experience in countries such as Jamaica, Dominican Republic and the OECS countries confirms that economic growth only recovers slowly from a major natural disaster. Disasters directly impact on the foreign exchange earnings capacity of a country, at a time when extra resources are needed to finance imports of food, energy, and inputs for the agricultural and manufacturing sectors. If sustainable development is to be achieved in the Caribbean region, countries will have to take effective measures to manage these natural hazard risks.

Box E.1: Main Natural Disasters in the Caribbean (1979–2001)

Year	Country (Hazard Type)	Persons Affected	Damage US (000's)*
1979	Dominica (David and Frederick)	72,100	$44,650
1980	St. Lucia (Allen)	80,000	$87,990
1988	Dominican Republic (Flood)	1,191,150	
1988	Haïti (Gilbert)	870,000	$ 91,286
1988	Jamaica (Gilbert)	810,000	$ 1,000,000
1989	Montserrat (Hugo)	12,040	$ 240,000
1989	Antigua, St. Kitts/Nevis, Tortolla, Montserrat (Hugo)	33,790	$ 3,579,000
1991	Jamaica (Flood)	551,340	$ 30,000
1992	Bahamas (Andrew)	1,700	$ 250,000
1993	Cuba (Storm)	149,775	$ 1,000,000
1993	Cuba (Flood)	532,000	$ 140,000
1994	Haiti (Storm)	1,587,000	
1995	St Kitts & Nevis (Luis)	1,800	$ 197,000
1995	US Virgin Islands (Marilyn)	10,000	$ 1,500,000
1998	Dominican Republic (Georges)	975,595	$ 2,193,400
2000	Antigua/Barbuda, Dominica, Grenada, St. Lucia (Lenny)		$ 268,000#
2001	Cuba (Michelle)	5,900,012	$ 87,000

** valued at the year of the event.*

Source: OFDA/CRED International Disaster Database (EM-DAT) 2002. #USAID/Jamaica 2000, Hurricane Lenny Recovery in the Eastern Caribbean.

Box E.2: Hurricane Georges, September 1998: Social and Economic Impact

In late September 1998, Hurricane Georges traveled through the region, causing significant damage in the north and northeastern Caribbean.

In *St. Kitts and Nevis,* physical infrastructure was severely damaged, including 85 per cent of the housing on St. Kitts. The majority of the country's schools and the primary hospital, and almost half of the sugar crop was lost. Most tourist facilities were closed for two months or more after the storm. Total losses were estimated at almost US$484 million. Damage in *Antigua and Barbuda* was concentrated on the southern coast of Antigua, with 400 homes destroyed. Tourism facilities on both islands sustained significant losses and damage to schools was over US$1.5 million.

In the *Dominican Republic,* over 200 people were killed by the storm and the health of hundreds of thousands of others was threatened by damages to potable water systems and health centers. The majority of crops, in particular on small farms, were damaged, leaving many in need of food assistance. Overall almost one million people were directly affected by the storm. A quarter of the roads, more than half the country's bridges and 1 of every 7 hotel rooms was destroyed or damaged. Over half of the forests in the eastern half of the country were damaged. Considerable losses of soil through flooding and erosion will have significant, long-term effects.[2]

The monetary loss from direct and indirect damage in *Haiti,* valued at $180 million, was lower than in surrounding countries, yet an estimated 300,000 people lost everything they owned. Crops, livestock and agricultural infrastructure sustained significant damage, leading to food security concerns in the rural areas. Erosion and soil loss from deforested hillsides were substantial.[3]

- Disasters associated with natural hazards are fundamentally an issue of development. Each natural disaster leaves in its wake an overwhelming volume of evidence of how planning and investment decisions contribute to vulnerability — and the consequent risk of further disasters. The location of a housing development, how it is constructed, and how land use affects the natural environment are all factors that contribute significantly to the damage inflicted during a hazard event. For the most part, this damage is avoidable by first investing in hazard assessments and then incorporating the findings of these assessments into decisions affecting future development. In this regard, Puerto Rico, also in the Hurricane George's path, escaped serious economic disruption and loss of life, primarily because it was better prepared. The experience of the British Virgin Islands also demonstrates the benefits of preventive steps to lessen the damage from recurring hurricanes. Since the management of natural hazards has a close link to a country's development prospects, it is essential that hazard considerations are incorporated more systematically into development planning and resource allocation processes, something that is currently not taking place.

- There is also a close link between environmental degradation and poverty, with low-income populations and communities being disproportionately affected by natural hazards. Limited resources, skewed land ownership and tenure patterns can drive the poor to settle on vulnerable land. Easy access to production resources can also prompt settlement of otherwise hazardous locations. Unsustainable natural resource use associated with poverty can exacerbate these existing vulnerabilities. Sectoral planning, resource allocation and land use decisions must give special attention to their repercussions on the vulnerability of low-income communities.

[1] USAID 1999. *Hurricane Georges Reconstruction and Recovery in the Eastern Caribbean, Special Objective Document.*
[2] USAID/Dominican Republic 1999. *Hurricane Georges Recovery and Reconstruction, Special Objective Document.*
[3] USAID/Haiti 1999. *USAID/Haiti Operation Bounce Back Post-Hurricane Georges Recovery Program.*

2. Hazard Risk Management: A New Approach to Recurring Natural Disasters

- Traditionally, disaster management has focused nearly exclusively on actions that can be taken immediately prior to, during, or shortly after a disaster event to reduce economic damage and loss of life. It has also often been seen as the sole responsibility of governments. In recent years, this traditional disaster management approach has been evolving slowly to include natural hazard risk management, in addition to preparedness, response, and recovery planning and management.

- Natural hazard risk management is significantly different from traditional preparedness and response activities. A traditional approach attempts to address existing problems, while hazard risk management focuses more on anticipating problems by ensuring that growth and development address the likelihood of hazards and their interaction with environmental systems. Whereas traditional preparedness and response mechanisms often focus on individual hazard events, risk management views hazard exposure as an ongoing process and aims at reducing vulnerability to these hazards across all sectors of society and the economy. Such an approach needs to become an integral part of economic planning and policy making.

- Outside of the traditional disaster management system, no comprehensive framework for coordinating multi-sectoral risk management activities has existed until recently. Two new regional initiatives, the development of a proposed *Strategy and Results Framework for Comprehensive Disaster Management in the Caribbean (CDM)* and the establishment of the *Disaster Mitigation Facility for the Caribbean (DMFC)* within the Caribbean Development Bank, significantly enhance the potential for integration of risk management into the region's development agenda.

Box E.3: Developing a Regional Risk Management Strategy

Comprehensive Disaster Management Strategy (CDM). In 2001, a working group, representing regional and national disaster management organizations, the private sector, regional technical institutions and multi- and bi-lateral donors and lending institutions developed a proposed *Strategy and Results Framework for Comprehensive Disaster Management in the Caribbean.* Funding for the development of this strategy was provided by USAID and UNDP. This strategy was undertaken with the objective of integrating comprehensive disaster management into the development process within the region, providing an important framework for strengthening and coordinating risk management efforts. The proposed CDM strategy emphasizes hazard risk reduction. Within this framework, the institutional capacity and role of the Caribbean Disaster Emergency Response Agency (CDERA) to promote CDM at the regional level will be strengthened. At the national level, consultations are being held to encourage governments to develop national strategies within the CDM framework and to identify champions for hazard risk management at the ministerial level and within the private sector.

Disaster Mitigation Facility for the Caribbean (DMFC). Also in 2001, with support from the USAID Office of Foreign Disaster Assistance, the Caribbean Development Bank (CDB) established the Disaster Mitigation Facility for the Caribbean, marking an important step towards the promotion and coordination of risk management within the region. The CDB assists borrowing member states, across a broad range of activities and sectors, including poverty reduction, infrastructure development and environmental management, placing it in a strong position to promote and coordinate activities in sectors that have not traditionally addressed directly hazard risk management. The DMFC will focus on the incorporation of hazard risk management into development decision making within the internal operations of the CDB, its borrowing member countries and regional institutions. Activities of the DMFC include support for strengthened building standards and enforcement mechanisms and assistance to member countries with the development of national-level risk management policies and plans.

- Disasters are typically seen as discrete events, such as a rainstorm, hurricane or earthquake. Damage from a disaster event, however, is the result of vulnerability that existed prior to the event. Little can be done to reduce the occurrence and intensity of most natural hazards, but their effects can be minimized through disaster preparedness and response activities, to safeguard lives, and hazard risk management activities and programs, to reduce existing and future vulnerability to damage and loss. Reducing vulnerability to near-term climate hazards is also an effective strategy for reducing long-

term risks to the effects of climate change. There are three main, interrelated categories of risk management actions—**risk identification, risk reduction and risk transfer.**

- **Risk Identification.** A thorough understanding of existing vulnerabilities, including their location and severity, is critical for the development and prioritization of investment programs and activities for hazard risk management. As the level of vulnerability can increase, or decline, with the aging of existing facilities and with new growth, determining underlying causes makes it possible to eliminate or reduce new vulnerabilities as communities, countries and the region as a whole develop. A broad range of activities contributes to the identification and understanding of natural hazard risk: hazard data collection and mapping, vulnerability assessment, risk assessment and post-disaster assessment.

- **Risk Reduction**. Risk reduction activities are designed to mitigate damage from hazard events. These activities address existing vulnerability through such measures as retrofit, strengthening and relocation. Actions taken to reduce future vulnerability, such as the implementation and enforcement of building standards, environmental protection measures, land use planning that recognizes hazard zones and resource management practices, will provide significant benefits over the long term. Risk reduction measures should lead to "safer" growth, rather than a further accumulation of vulnerability. However, they should always complement activities to safeguard individuals and resources exposed to existing vulnerabilities. Risk reduction measures can be directed towards physical, social and environmental vulnerability.

Box E.4: Dominican Republic: Community involvement in reducing risks

In the Dominican Republic, the Asociación Dominicana de Mitigación de Desastres (ADMD) and a coalition of NGOs have championed disaster preparedness and prevention among the most vulnerable communities, conducting workshops in over 700 communities since 1995. In these workshops, local participants prepare a community emergency plan, which is built on an assessment of local hazard vulnerabilities and of locally available resources to address those vulnerabilities. During hurricane Georges (1998), communities that had established emergency committees through this program successfully evacuated people from flood prone areas, established shelters, organized clean-up brigades, and requested and distributed assistance without incident. In addition, these communities have identified and implemented small risk reduction projects and actions. Projects, such as the construction of containment walls and drainage ditch embankments, are designed to address local health and environmental contamination problems as well as reduce and mitigate the constant floods and landslides, which are a daily concern for these communities. The positive effect of these initiatives was demonstrated by the reduced impact of hurricane Georges on the participating communities.

- **Risk Transfer.** It is often not possible to eliminate completely the vulnerability of key assets. In small island states, there may be critical components of the nation's infrastructure for which no replacement is readily available. In such cases, it is important to strengthen fiscal resilience and to reduce financial risk through mechanisms that ensure funds are readily available to rectify the damage or replace the facility should a loss occur. Utilizing the insurance mechanisms is appropriate for risks that cannot be mitigated through structural or ex-ante damage reduction measures, and against events that have the potential to cause large economic losses. Limiting public- and private-sector debt and creating contingency funds also build up economic resilience to the effects of natural hazards.

3. Review of risk management practices in the Caribbean

- As a foundation for this report, a comprehensive review of hazard risk management practices in a number of Caribbean countries has been undertaken. As part of this review, the report identified certain activities as 'good' practices, which are intended to provide practical guidance to governments and other organizations. Using these 'good' practices as a yardstick, assessments of actual management practices in several regional countries were carried out. The status of practices and gaps in Jamaica, Dominican Republic, and individual OECS countries is summarized in the matrix tables, which are presented in a separate technical annex to this report.

- This paper focuses exclusively on policies and practices for long-term hazard risk management, through risk identification, risk reduction and risk transfer approaches at the community, national, sub-regional and regional levels. Preparedness, response and recovery activities are not included in the analysis framework adopted in this paper. This is not to imply that these activities are not important; effective risk management is not possible without them. Despite existing discussions and successful pilot initiatives, natural hazard risk management initiatives do not have the same constituency and political support as do the traditional disaster management activities. Accordingly, the work outlined in this paper addresses that gap by focusing exclusively on hazard risk management.
- This review established that there is already considerable experience with risk management in the region. However, the existing knowledge is not well developed, has not been widely shared and has not been incorporated into mainstream development decisions in either the public or private sector. The main reasons for this are:
  a. a continued perception that risk management is the sole province of government agencies responsible for disaster management rather than a shared responsibility involving sector ministries, trade associations, and the private sector;
  b. low public demand for risk management measures due to complacency, a lack of understanding of the risks involved, and the perceived cost of these measures;
  c. a lack of dissemination and public education with respect to the potential benefits and successful experiences with hazard risk management;
  d. a lack of effective coordination between governments, regional, and international financing agencies in developing a framework for hazard risk management;

Box E.5: Hazard Risk Management in the British Virgin Islands

Background. Hurricane Hugo had a traumatic impact on the physical and socio-economic fabric of the BVI in September 1989. Losses amounted to US$40 million and 30 per cent of the country's housing stock was destroyed. This event was a catalyst for introduction of an administrative, operational and policy framework to reduce the impacts of future hazard events. In response, the Government recruited regional disaster management professionals for advice on how best to strengthen the country's technical capacity for disaster management.

A new approach to disasters. The post-Hurricane Hugo assessment study undertaken in 1993 represented an important departure from the traditional approaches to disaster management that focused on response and recovery and shifted the emphasis to mitigation. This study influenced all subsequent work on hazard assessment and disaster mitigation in the BVI, including the 1997 Hazard Risk Assessment, the 1999 Building Regulations, revised development standards, environmental protection measures and the current Mitigation Strategy, which was recently submitted to Executive Council.

Lessons.

1. Disaster and hazard risk management in the BVI has benefited tremendously from strong political support of the territory's Governor and Deputy Governor. Successive Chief Ministers have also provided financial and political support.
2. Much emphasis has been placed on public awareness and education for disaster and hazard risk management. The aggressive approach of the national disaster agencies is reflected in the high level of consciousness among residents of the need to adopt appropriate hazard resistant construction techniques. Almost all new buildings are equipped with hurricane shutters, which are manufactured locally and exempted from government taxes—a practical example of government's commitment to disaster mitigation.
3. The BVI has pursued an integrated approach to disaster management at the institutional level. Collaboration between the Physical Planning Department, Development Planning Unit and the Department of Disaster Management resulted in a framework for incorporating disaster and hazard risk management into physical and economic planning. The disaster office, for instance, provides direct budget assistance to other sectors in the development of hazard contingency plans.

e. collective absence of political will across governments, private sector institutions, and international financing agencies in enforcing existing standards; and

f. a lack of widespread technical know-how on the use of insurance risk modeling techniques by both public sector planners and private sector local insurance industries to project potential loss exposures on both specific sites and for wider geographical areas.

- Notwithstanding these shortcomings, the recent development of a comprehensive disaster management strategy for the region and the establishment of a disaster management facility at the CDB are important steps in the right direction. They reflect a growing consensus as to which and where the main interventions are needed for hazard risk management.

4. Institutional and Coordination Implications

- Effective hazard risk management requires close coordination of all activities and the participation of all sectors of the economy: national disaster agencies, sector ministries, business and private sector organizations, as well as community level organizations. At the national level, it is the individual sector ministries rather than the national disaster offices that are best placed to implement hazard risk management measures, since they are directly responsible for investments that affect actual levels of vulnerability to natural hazards. Investments in key sectors such as agriculture, forestry, fisheries, housing and public works can degrade natural protective systems and end up increasing disaster impacts if proper consideration is not given to vulnerability issues. Since low-income communities are often more vulnerable to natural hazards than the population at large, sectoral investment planning and resource allocation processes need to give particular attention to the vulnerability of these communities.

- The involvement of business, industry and civil society organizations is critical to strengthening public sector risk management activities. Businesses rely on government to set proper building standards, but incentives such as insurance premium reductions or 'seals of approval' for good practice are also needed. While private sector interests are normally represented on national disaster bodies, private and public sector hazard risk management efforts in most countries of the Caribbean are not well coordinated.

Box E.6: Disaster Preparedness and the Private Sector: The Grace Kennedy Group in Jamaica

In Jamaica, the Grace Kennedy Group actively pursues hazard risk management throughout its operations. With the assistance of the Jamaica Office of Disaster Preparedness and Emergency Management, the company has developed and tested a disaster manual and a business continuity plan. Safety and vulnerability audits are conducted regularly on its buildings and facilities. A Group Disaster Preparedness Committee oversees disaster and safety-related activities. Safety reports are included on the primary agenda of the Grace Kennedy board meetings.

- Regional level involvement is also needed. The small size and limited internal capacity of a number of countries in the region limit what can be undertaken at the national level and strongly argue for a greater emphasis on collaboration and decision making at the sub-regional and regional level. Specifically, regional centers of expertise need to be established, within existing regional institutions, with the mandate and funding to provide hazard risk management assistance in areas such as hazard mapping, vulnerability assessment and building code implementation and enforcement. Financial management of natural hazard risks via the use of insurance should also exploit the economies of scale and pricing achievable through the establishment of sub-regional funding mechanisms for this purpose, while differentiating among the different risk profiles of each country.

- Coordination amongst multilateral and bilateral financing agencies must also be improved. To date, little coordination amongst the financing agencies has taken place, in part due to a traditional focus on, and response to, specific hazard events. At the same time, there has been no consistency in

applying common standards when financing new infrastructure and local development programs. For progress on hazard risk management within countries and the region, donors will need to coordinate actions in a common framework and use consistent standards.

5. The Way Forward—A Program for Action

- If the economic and social impact of future disasters is to be reduced, current practices and policies cannot continue. A new approach to disaster management in the Caribbean is called for, one that incorporates the experience and good practices from hazard risk management and becomes integral to economic planning, investment decision and donor assistance. This approach also needs to build on initiatives already underway, with sustained donor support, in both CDERA and the CDB to improve coordination and integration of risk management activities in the region. Possible priority actions and proposed institutional responsibilities to initiate the implementation of this approach are indicated in the table below.

- Better understanding of the nature, magnitude and potential impact of natural hazard risks is a prerequisite to policy making, as is a clear understanding of the level of risk that various actors should and can assume. To this end, technical capacity in the region needs first to be strengthened by identifying and supporting regional centers of expertise and establishing common methodologies for risk mapping and vulnerability assessments within the region.

- Hazard mapping information and vulnerability assessment tools ought to be further exploited to project contingent liabilities of both the public and the private sectors with regard to potential natural hazard events. This should be coupled with judicious consideration of cost effective risk reduction options and transfer mechanisms which maximize protection while minimizing cost.

- Cooperation between governments, the business community and industry towards hazard risk management needs to be strengthened at both national and regional levels. This should be supported by easily available quality information, coupled with implementation of awareness campaigns and training programs. Also, government programs must be complemented by incentives to the private sector to adopt appropriate risk management practices.

- At the national level, economic resilience must be strengthened through limiting debt, creation of disaster contingency funds and transferring of risks. Political will, particularly in the area of enforcement of land use planning and building codes, is a prerequisite for any progress.

- The particular vulnerability of low-income communities needs to be recognized, their potential role in identifying and addressing local hazard risks need to be developed and specific micro-credit, cooperative and self-insurance schemes should be implemented.

I. Identify and Provide Financial Support for Regional Centers of Expertise

Action	*First Step*	*Possible Lead Agency(ies) for Initial Step*	*Link to CDM strategy*
Regional Center(s) of Expertise for Hazard Identification and Vulnerability Assessment. Identify and support regional centers of expertise for hazard mapping, vulnerability assessment and natural hazard impact assessment.	Conduct baseline institutional assessment and review of existing materials. Organize regional consultation to identify and designate appropriate center(s).	CDB DMFC, CDERA, UWI	IR 1.3 IR 2.2
• **Common Methodologies.** Develop common regional methodologies for hazard mapping, vulnerability assessment and natural hazard impact assessment.	Identify and review existing methodologies, draft model approach for testing.	CDB DMFC, CDERA, UWI, OAS	IR 1.3
Regional Center(s) of Expertise for Risk Reduction Measures. Identify regional center to strengthen building practices, to harmonize existing legislation (including building codes, physical planning and disaster management) and to develop appropriate enforcement mechanisms.	Organize baseline review and regional consultation to identify and designate appropriate center(s).	CARICOM Secretariat, UWI Engineering	IR 1.3 IR 2.2
• **Enhanced Implementation of Risk Reduction Measures.** Strengthen implementation and enforcement capacity for building codes and physical development standards within the region.	Conduct assessment of the weaknesses of the present system and the potential links to private sector interests.	CDB DMFC, OECS/NRMU, IAC	IR 4.1 #3 IR 5.1 #3
• **Current Building Standards.** Update the Caribbean Uniform Building Code and include provisions to address adaptation to climate change.	Review and support existing proposal to update CUBiC.	CDB DMFC, CARICOM Secretariat	
• **Coordinated Initiatives.** Develop a mechanism for integrating public and private sector risk management information and experiences.	Identify measures to stimulate business and industry to undertake risk management measures in coordination with Governments. Identify government incentives that could motivate business and industry to minimize risks.	CTO, CHA/CAST, IAC, CLAA, PADF	

II. Mainstream Hazard Risk Management

Action	*First Step*	*Possible Lead Agency(ies) for Initial Step*	*Link to CDM strategy*
Information Clearinghouses. Identify national and regional clearinghouses for hazard information; develop open sharing and distribution mechanisms for hazard information, for governments, the private sector and the public in general.	Organize baseline review of potential institutions. Develop model data sharing and distribution guidelines.	CDERA, UWI, CDB DMFC	IR 2 3
Development and Economic Growth. Integrate hazard risk management into development decision-making through planning and budgeting, with emphasis on the impacts of decisions and resource allocations on critical facilities and in low-income communities.	Review good practices and develop methods for integrating risk appraisal into the public-sector budget process. Develop risk management training components for government and private sector development planning courses.	CDB DMFC, ECLAC	IR 4.5 #3
Legal Framework. Adopt national building codes, physical planning acts and corresponding administrative and enforcement mechanisms.	Finalize adoption of building codes, where pending. Develop model for code administration Develop, adopt and implement updated physical planning legislation and frameworks.	National Cabinets	IR 3.2 IR 4 1
Incentives for Risk Management. Establish public and private sector incentives for proper risk management, such as insurance premium reductions and tax incentives.	Identify and publicize successful public and private sector incentives for appropriate risk management practices. Define training needs.	ECCB, Ministries of Finance, Chambers of Commerce, IAC, Banking Sector	IR 5.2

III. Expand Use of Risk Transfer Measures

Action	*First Step*	*Possible Lead Agency(ies) for Initial Step*	*Link to CDM strategy*
Public Sector Exposure. Understand and define limits of public sector responsibility for hazard risks	Review levels of existing risk, including key infrastructure, and determine the level of risk that can be assumed.	Ministries of Finance, ECCB	
• **Vulnerable Communities.** Address the special vulnerabilities of low-income communities.	Develop micro-credit, cooperative and self-insurance schemes.	ECCB, Ministries of Finance, Community NGOs, National Development Foundations	
Sharing Risk. Develop risk pooling mechanisms at the sub-regional and regional levels.	Implement the Eastern Caribbean Risk Pooling proposal.	ECCB, CDB	
Insurance Industry. Strengthen oversight of the insurance industry and rationalize market.	Improve insurance supervision at the national and regional levels and ensure adequate reserves for retained risk.	ECCB, IAC	[IR 3 3]

IV. Donors and Regional Lending Institutions to Promote Risk Management

Action	*First Step*	*Possible Lead Agency(ies) for Initial Step*	*Link to CDM strategy*
Donor Support. Strengthen commitment to risk management considerations in all funded activities.	Incorporate hazard and vulnerability assessment in project design and appraisal, using consistent methodologies and standards during project preparation and execution	CDB, Bi-lateral Donors, UNDP, IDB, World Bank	IR 3.1
Donor Coordination. Coordinate risk management activities in the region with other donors and lending institutions using the CDM framework.	Establish mechanism for coordination of donor-funded risk management initiatives, through existing donor groups or through a new mechanism.	Eastern Caribbean Donor Group, CDB, World Bank, IDB	IR 3.1

NATURAL HAZARD RISK MANAGEMENT IN THE CARIBBEAN: REVISITING THE CHALLENGE

This paper is the result of a systematic compilation of good practices in hazard risk management in the Caribbean and a comprehensive review and assessment of actual risk management practices currently in place in Antigua and Barbuda, the British Virgin Islands, Dominica, the Dominican Republic, Grenada, Jamaica, St. Kitts and Nevis, Saint Lucia and St. Vincent and the Grenadines. The purpose of this work is to provide a new perspective on hazard risk management, different from traditional disaster management approaches, and to identify appropriate models, actions, actors and institutional mechanisms for advancing natural hazard risk management in the region. The good practices assembled under this activity provide a menu of options for action at the local, national, sub-regional and regional levels.

The recommendations and proposals developed in this paper support the frameworks and objectives of the proposed Comprehensive Disaster Management (CDM) strategy and the Disaster Management Facility for the Caribbean (DMFC) recently established at the Caribbean Development Bank (CDB). They are intended to expand these discussions by highlighting the critical role of sectors not traditionally involved in hazard risk management, including development planning and the private sector, and by focusing on the need for stronger regional support for national and local level risk management interventions.

This paper focuses exclusively on policies and practices for long-term hazard risk management, through risk identification, risk reduction and risk transfer approaches at the community, national, sub-regional and regional levels. Preparedness, response and recovery activities are not included in the analysis framework adopted in this paper. This is not to imply that these activities are not important; effective risk management is not possible without them. Disaster preparedness, response and recovery activities are already on the agenda of politicians and decision-makers in the region, and specialized agencies with a mandate for such activities exist at the national and regional level in the Caribbean. A comprehensive disaster management framework for strengthening these activities, through the Caribbean Disaster Emergency Response Agency (CDERA), has recently been developed. Despite existing discussions and successful pilot initiatives, natural hazard risk management initiatives do not have the same constituency and political support as do the traditional disaster management activities. Accordingly, the work outlined in this paper addresses that gap by focusing exclusively on hazard risk management.

I. Natural Disasters – A Development Issue

A. Macroeconomic Impact

Earthquakes, volcanoes, hurricanes and floods gave birth to the lands and islands of the Caribbean. These natural events have defined and shaped the region's lands and inhabitants. With population and economic growth within the region, however, these same events pose a growing threat to the national and regional development strategies. In the Latin America and Caribbean region, direct and indirect damages from natural hazards over the past thirty years have been estimated at between US$700 million and $3.3 billion annually.[4] Direct losses include deaths, damage or destruction of key infrastructure. Indirect costs cover interruptions to economic activities, lost productive capacity and increase costs due to the hazard event.

Longer-term damages, such as irreversible changes in the natural resource base, are often more difficult to quantify and often missed in such estimates. Within the Caribbean, countries have incurred losses approaching and exceeding the annual GDP from a single hurricane event. In Jamaica, damage from hurricane Gilbert equaled approximately 65 per cent of the GDP and in Montserrat hurricane Hugo caused damage equivalent to twice the island's GDP. With increasing frequency, countries in the region

[4] Inter-American Development Bank 2002. *Natural Disasters in Latin America and the Caribbean: An Overview of Risk.*

are facing situations in which scarce resources that were earmarked for development projects have to be diverted to relief and reconstruction following disasters, thus setting back economic growth.

Box 1: Main Natural Disasters in the Caribbean (1987–2001)

Year	Country (Hazard Type)	Persons Affected	Damage US (000's)*
1979	Dominica (David and Frederick)	72,100	$44.650
1980	St. Lucia (Allen	80,000	$87.990
1988	Dominican Republic (Flood)	1,191,150	
1988	Haïti (Gilbert)	870,000	$ 91,286
1988	Jamaica (Gilbert)	810,000	$ 1,000,000
1989	Montserrat (Hugo)	12,040	$ 240,000
1989	Antigua, St. Kitts/Nevis, Tortolla, Montserrat (Hugo)	33,790	$ 3,579,000
1991	Jamaica (Flood)	551,340	$ 30,000
1992	Bahamas (Andrew)	1,700	$ 250,000
1993	Cuba (Storm)	149,775	$ 1,000,000
1993	Cuba (Flood)	532,000	$ 140,000
1994	Haiti (Storm)	1,587,000	
1995	St Kitts & Nevis (Luis)	1,800	$ 197,000
1995	US Virgin Islands (Marilyn)	10,000	$ 1,500,000
1998	Dominican Republic (Georges)	975,595	$ 2,193,400
2000	Antigua/Barbuda, Dominica, Grenada, St. Lucia		$ 268,000#
2001	Cuba (Michelle)	5,900,012	$ 87,000

** valued at the year of the event.*

While most countries in the region look to international lending institutions and bilateral donor agencies for help with recovery from disasters, rarely do the funds received offset the losses incurred. Disasters directly impact on the foreign exchange earnings capacity of a country, at a time when extra resources are needed to finance post-disaster imports of food, energy, and inputs for the agricultural and manufacturing sectors. After the 1995 hurricane season in Dominica, during which the island was struck by one tropical storm and two hurricanes, a study was undertaken comparing the levels of damage and disaster assistance in the country. This study identified US$66.7 million in damages, equivalent to 35 per cent of GDP. By August of the following year, pledges from grants and loans covered only 25 per cent of those losses and insurance payments, an additional 13 per cent.[5] If sustainable development is to be achieved in the Caribbean region, countries will have to take effective measures to manage natural hazard risks.

Each disaster leaves in its wake an overwhelming volume of evidence of how planning and investment decisions may contribute to vulnerability and the consequent risk of disasters. Where we choose to locate development, how it is constructed and how our development practices and use of the land affect natural environmental systems are all factors that contribute significantly to the impacts experienced during a hazard event. Development along floodways or under-design of infrastructure in high-hazard coastal locations invites damage and loss of key infrastructure or homes. Inappropriate farming and forestry practices in upper watersheds can significantly increase flood levels and speeds lower in the basin. Inappropriate sand mining can limit the ability of the beach to buffer wave and surge energy, and to regenerate after a storm event. Improper cutting of slopes or excess loading of unstable slopes when building roads can cause land slippage or rock falls that damage the road, surrounding developments and vegetation. These damages are, for the most part, avoidable, with investment in hazard assessments and

[5] Government of the Commonwealth of Dominica, 1995. *Tropical Storm and Hurricane Damage and Rehabilitation (1995)* and Ministry of Finance, Government of Dominica.

the will and commitment to incorporate management of hazard risk into decisions affecting and guiding development at all levels.

B. Natural hazards, environmental degradation and poverty

The environment and ecosystems of the Caribbean evolved within the context of the natural hazards that affect the region. Undisturbed by human development, natural systems have adaptive mechanisms to absorb hazard impacts, enabling eventual recovery from the damages sustained. Development in hazardous areas can weaken natural systems sufficiently to render recovery impossible. The cutting of mangrove trees for firewood leaves a previously protected coastline and any remaining mangrove vulnerable to waves and surges from passing storms. Natural adaptive responses to hazards, such as the erosion of sandy beaches during a storm, can themselves damage or destroy infrastructure and coastal development, if not properly accounted for in the original planning and design. Healthy natural systems generally recover from the impacts of natural hazards, although not necessarily to their original state or within a short time period. Natural rebuilding of beaches eroded by significant hazard events typically begins shortly after the event. Beaches in the Eastern Caribbean affected by Hurricane Luis (1995) had recovered between 70 and 80 percent of the sand lost during the storm within 6 to 12 months.[6] Full recovery, however, may take years and tourism revenues and buildings lost due to the eroded beaches cannot be recouped.

Numerous examples exist of increased hazard risk due to environmental degradation and development in the Caribbean. A recent assessment of the drought hazard in Antigua identified uncontrolled grazing as one of the most significant factors contributing to drought susceptibility across the island. In 1997 in Dominica, the landslide-induced damming and subsequent dam breach of one of the country's rivers caused considerable flooding of the community at the mouth of the stream; a road located above the landslide site was identified as one of the causes of this significant slide. Degradation of coral reefs throughout the region is exposing previously protected stretches of coastline to the full force of storm-related surges and waves.

Box 2: Impacts of Hurricane Georges (1998)

In late September 1998, Hurricane Georges traveled through the region, causing significant damage in the north and northeastern Caribbean.

In **St. Kitts and Nevis,** physical infrastructure was severely damaged, including 85 per cent of the housing on St. Kitts, the majority of the country's schools and the primary hospital, and almost half of the sugar crop was lost. Most tourist facilities were closed for two months or more after the storm. Total losses were estimated at almost US$484 million. Damage in **Antigua and Barbuda** was concentrated on the southern coast of Antigua, with 400 homes destroyed. Tourism facilities on both islands sustained significant losses and damage to schools was over US$1.5 mill.[7]

In the **Dominican Republic,** over 300 people were killed by the storm and the health of hundreds of thousands of others was threatened by damages to potable water systems and health centers. The majority of crops, in particular on small farms, were damaged, leaving many in need of food assistance. Overall almost one million people were directly affected by the storm. A quarter of the roads, more than half the country's bridges and 1 of every 7 hotel rooms was destroyed or damaged. Over half of the forests in the eastern half of the country were damaged. Considerable losses of soil through flooding and erosion will have significant, long-term effects.[8]

Direct and indirect damage in **Haiti,** valued at $180 million, was lower than in surrounding countries, yet an estimated 300,000 people lost everything they owned. Crops, livestock and agricultural infrastructure sustained significant damage, leading to food security concerns in the rural areas. Erosion and soil loss from deforested hillsides were substantial.[9]

---

[6] Cambers, G. 1996. *Hurricane impact on beaches in the eastern Caribbean islands 1989-1995* COSALC Report.
[7] USAID 1999. *Hurricane Georges Reconstruction and Recovery in the Eastern Caribbean, Special Objective Document*
[8] USAID/Dominican Republic 1999. *Hurricane Georges Recovery and Reconstruction, Special Objective Document*
[9] USAID/Haiti 1999. *USAID/Haiti Operation Bounce Back Post-Hurricane Georges Recovery Program.*

Low-income groups are often disproportionately affected by natural hazards. Limited resources or land ownership and tenure patterns can induce poorer individuals to settle on vulnerable lands, such as unstable slopes, riverbanks or low-lying coastal areas. Easy access to useful resources, including fishing grounds or the fertile soils on volcanic slopes, can prompt settlement of otherwise hazardous locations. The lack of a financial buffer or a long-term claim to land can lead to destructive management practices of natural resources surrounding low-income settlements, exacerbating hazard risks. Indiscriminant cutting of forests for firewood in surrounding watersheds can increase flood and erosion risks. Clearing of mangroves at the water's edge and improper waste disposal can destroy important fish nursery habitats and the fish stocks that depend upon them. Sectoral planning, resource allocation and land use decisions must therefore give special attention to their repercussions on the vulnerability of low-income communities.

The impact of climate change, including sea level rise, the increase in extreme weather events and changes in weather and precipitation patterns, adds to these concerns in the Caribbean. In attempting to understand the impact of future climate change, much can be learned from the impact of present-day climate extremes. Proper hazard risk management generally contributes to efforts to adapt to climate change.[10] The techniques used to determine the impacts of climate change are closely related to those used in vulnerability assessments for natural hazards. Similarly, natural hazard risk management and adaptation to climate change draw on the same institutional capacities and technical skills.

II. Hazard Risk Management : A New Approach to Recurring Natural Disasters

A. Risk Management : A Broader Perspective

Traditionally, hazard risk management has focused nearly exclusively on actions that can be taken immediately prior to, during or shortly after a disaster event to reduce damage, injuries and death, and has been seen as the sole responsibility of governments, in particular emergency and disaster response agencies. In recent years, this traditional disaster management approach has evolved and expanded to include natural hazard risk management in addition to preparedness, response and recovery planning and management. This evolution to risk management did not happen spontaneously. It was prompted by a series of significant hazard events and increasing physical and economic damage over recent decades, as well as by a growing understanding of the links between development practices, environmental degradation and hazard impacts.

1. Solving problems before they become disasters

Natural hazard risk management is significantly different in nature from traditional preparedness and response activities. The traditional approach attempts to amend existing problems, while hazard risk management focuses on avoiding future problems by ensuring that growth and development are properly adapted to prevalent hazards and environmental systems. Whereas traditional preparedness and response mechanisms often focus on individual hazard events, risk management views hazard exposure as an ongoing accumulation or reduction of vulnerability, which is released during hazard events.[11]

2. Enhancing coordination of existing activities

Proper attention to each component of the disaster cycle is critical to the overall success of hazard risk management. Appropriate preparedness, response and recovery activities have proven successful at reducing damage and destruction. Advances in these areas, however, can be quickly overridden by

---

[10] Vermeiren 2001. "Increasing the Resilience to Hurricanes as a Strategy to Reduce Climate Change Risk." Presented at the US Southern Command Conference on Regional Cooperation in Disaster Prevention and Response in Central America", San Jose Costa Rica, March 2001.

[11] Lavell, Allan, *Decision Making and Risk Management.* Paper presented at the Conference on "Furthering Cooperation in Science and Technology for Caribbean Development", Port of Spain, Trinidad, 23–25 September 1998.

increased overall vulnerability caused by improper development or environmental damage accompanying economic and population growth. While comprehensive approaches to hazard risk management are relatively new, many important components of such a strategy exist within the Caribbean. Coordination of regional activities, models and tools is important to ensure that these efforts support integrated hazard risk management within the region. Outside of the traditional disaster management system, no comprehensive framework for coordinating these activities has existed until recently. Two new regional initiatives, the proposed strategy for comprehensive disaster management (CDM) in the Caribbean and the establishment of the Disaster Mitigation Facility for the Caribbean (DMFC) within the CDB, have the potential to dramatically improve coordination and integration of risk management activities in the region.

The importance of private businesses and industry organizations in the coordination of investment and human development activities should not be underestimated. As the engine of long term development, each business and the industry associations that support them must include risk identification, hazard assessment and risk reduction measures in their business plans. Vulnerability reduction, a normal practice in business planning, needs to be more sharply focused, based on new and more detailed hazard information. Such efforts must also be coordinated with risk management initiatives of national governments, international financial institutions and regional centers of expertise in hazard risk management. Such coordination between the public and private sectors is not without costs and carries some risks, such as the possibility that costs may rise or investments discouraged when hazards and risks are better identified, but it is essential to the long-term sustainability of public and private sector investments in the Caribbean.

B. Dimensions of Hazard Risk Management

Disasters are typically seen as discrete events, occurring at a specific point in time and associated with a specific trigger, such as a rainstorm, hurricane or earthquake. Damage from a disaster event, however, is the result of vulnerability that existed prior to the event, vulnerability that has often accumulated over an extended period of time. Since little can be done to reduce the occurrence and intensity of most natural hazards, hazard risk management activities and programs necessarily focus on reducing existing and future vulnerability to damage and loss. There are three primary, interrelated categories of risk management actions—**risk identification, risk reduction and risk transfer.**

1. Risk Identification

A thorough understanding of existing vulnerabilities, including their location and severity, is critical for the development and prioritization of investment programs and activities for hazard risk management. As the level of vulnerability can increase, or decline, with the aging of existing facilities and with new growth, determining underlying causes makes it possible to eliminate or reduce new vulnerabilities as communities, countries and the region as a whole develop. A wide range of activities contribute to the identification and understanding of natural hazard risk:

- ***Hazard data collection and mapping.*** Identification and proper communication of locations subject to hazards and the expected severity of hazard effects inform many other components of hazard risk management, such as development siting, environmental protection and insurance coverage. Formal hazard mapping projects and geographic information system (GIS) database development are typical examples of hazard identification and documentation activities. When properly coordinated, ongoing activities across a broad range of sectors, both private and public, can also contribute to a better understanding of prevalent natural hazards. Environmental impact assessments and insurance claims databases, for instance, contain information that can be used to validate or update local and national hazard knowledge. At the regional level, universities and specialized institutions house critical expertise and information for hazard mapping and analysis. Mechanisms for sharing hazard maps and communicating available hazard information are necessary to ensure that available hazard information is accurate and to make optimal use of the resources expended on hazard mapping and assessment.

- ***Vulnerability assessment.*** Vulnerability assessments are systematic examinations of building elements, facilities, population groups or components of the economy to identify features that are susceptible to damage from the effects of natural hazards. Vulnerability is a function of the prevalent hazards and the characteristics and quantity of resources or populations exposed to their effects; it can have social, economic, physical and environmental components. Vulnerability can be estimated for individual structures, for specific sectors or for selected geographic areas (e.g., areas with the greatest development potential or already developed areas in hazardous zones.) Information from vulnerability assessments is critical to determine appropriate and safe uses of facilities, to identify weak links in infrastructure systems and to prioritize limited retrofit and use of rehabilitation funds.
- ***Risk assessment.*** Risk assessment is performed by applying the probability of a specific hazardous event to the vulnerability of resources, facilities and populations affected by such an event, to determine the expected loss from its impact. Risk assessments provide critical information on the potential economic impact and costs associated with hazard-related risks. Such information is key for developing budget estimates for and prioritizing hazard risk management interventions.
- ***Post-disaster assessment.*** Even the most robust program of hazard mapping and vulnerability assessment will fail to identify some existing vulnerabilities, due to concealed hazards and weaknesses or an incomplete understanding of hazard impacts and interactions. Assessments of damage incurred in a hazard event can provide important new insights into hazard-related forces and into deficiencies in current development management systems, such as specific building practices, environmental management programs and development policies.

2. *Risk Reduction*

Risk reduction activities are designed to minimize or eliminate damage from hazard events. Risk reduction measures can address existing vulnerability through such measures as retrofit, strengthening and relocation. Actions taken to reduce future vulnerability, such as the implementation and enforcement of building standards, environmental protection measures and resource management practices, can have a more profound effect over the long term, but must always be paired with activities to safeguard individuals and resources exposed to existing vulnerabilities. Risk reduction measures can be directed towards physical, social and environmental vulnerability. The post-disaster period provides an important window of opportunity for implementing risk management measures.

- ***Physical measures.*** Physical risk reduction measures are divided into structural and non-structural actions. Structural risk reduction measures include any actions that require the construction or strengthening of facilities or altering of the environment to reduce the effects of a hazard event, such as flood- and wind proofing, elevation, seismic retrofitting and burial of utilities; in this context, the term 'structural' applies to a broader range of actions than implied by its definition within the engineering community. Non-structural measures are policies and programs that guide future development and investment towards reduced hazard vulnerability. Examples of non-structural measures include physical development plans, development regulations, acquisition of hazardous properties, tax and fiscal incentives and public education.
- ***Socio-economic measures.*** Social risk reduction measures are designed to address gaps and weaknesses in the systems whereby communities and society as a whole prepare for and respond to disaster events, with the ultimate goal of increasing the resilience of individuals and communities to hazard effects. Many agencies and groups play a role in building such resilience. National Disaster Offices, through their district- or community-level organizations, build awareness of hazards and vulnerabilities and help construct community and mutual assistance networks and programs. Public- and private-sector employment protection programs help ensure the availability of jobs and income after hazard events. Effective community- and national-level social networks and health systems also contribute to assuring continuity and recovery after a disaster event. Weaknesses in these systems are often concentrated in disadvantaged areas and groups. High land prices often push poorer communities onto marginal, hazard-prone sites, such as steep slopes or low-lying coastal areas. Lack

of access to alternatives often leads to unsustainable uses of natural resources in such communities, such as deforestation and poor agricultural practices, which lead to higher vulnerability to natural hazards. Addressing these underlying social and economic problems can effect a significant decrease in current and future hazard vulnerability. Activities that help build individual and community hazard resilience require a parallel strengthening of the capacity of the State to anticipate and respond to future extreme events, since failures at the national level can render many community initiatives ineffective.

- ***Environmental measures.*** Environmental risk reduction measures are designed to protect existing, or rehabilitate degraded, environmental systems that have the capacity to reduce the impacts of natural hazards. These can take the form of policies and programs, such as development control or environmental impact assessments, that reduce or eliminate the effect of human activities on the environment. They can also include physical measures that restore or fortify damaged environmental systems, such as coral reef protection, reforestation of critical watersheds or restoration of degraded river courses. Man-made hazards often occur as secondary effects of hazard events, e.g. oil spills caused by flooding. The potential for such secondary hazards should be accounted for in natural hazard risk management activities, as they often cause more significant environmental damage than do the primary hazard effects. Incorporating natural hazard impact assessments, which identify potential hazard impacts on a proposed project, into project development and permit approval process can potentially significantly reduce hazard risk in new developments. The CDB DMFC is developing a standard approach to natural hazard impact assessment for use in the region.
- ***Post-disaster measures.*** In the aftermath of a disaster, there is great pressure to repair damage quickly. However, the quality of the reconstruction and rehabilitation work that takes place during this period often determines how well the same system weathers future hazard events. Time and budget pressures and the difficulties in communication and transport in the post-disaster environment make it difficult to increase resilience during reconstruction. Putting in place pre-approved and tested reconstruction plans and procedures, with identified financing, can significantly reduce vulnerability to future hazard events, while overcoming the traditional time and budget constraints. Although reconstruction measures are a component of long-term response and recovery, they form a critical component of a comprehensive risk reduction program, as the recovery period provides an important window of opportunity for implementing necessary risk reduction measures.

3. Risk Transfer and Financing

It is often not possible to eliminate completely the vulnerability of key assets either because some assets, due to their function or to prior location decisions, are located in hazardous areas or because retrofitting is too expensive or may take an extended period of time. In small island states, there are often critical components of the nation's infrastructure for which no replacement is readily available. In such cases it is important to reduce financial risk through risk transfer mechanisms, which ensure that funds are readily available to rectify the damage or replace the facility, should a loss occur.

Risk transfer mechanisms do not reduce actual vulnerability and are often inefficient from a cost perspective. Consequently, all efforts to reduce the vulnerability of the assets to be covered should be taken before transferring the risk. To be sustainable, insurance mechanisms should qualify risks and strive to bring in good risks, not serve as a dumping ground for bad or unwise risks. Great reliance on reinsurance in the Caribbean makes insurance prices in the region vulnerable to shocks unrelated to immediate disaster experiences in the region.

- ***Budget self-insurance.*** The owner of a property—the government, a private company or an individual—allocates a modest yearly budget to spend on improved maintenance and on selected retrofit investments, which have the effect of reducing future expected losses in the event of a disaster. This enables the owner either to forego the purchase of regular insurance or to accept a higher deductible, thus reducing the cost of insurance.

- ***Market Insurance and Reinsurance.*** Insurance provides coverage for damage and expenses that are beyond the potential for budget self-insurance. Market insurance stabilizes loss payments through pre-payment in the form of regular premium payments. Once the extent of coverage has been agreed and premiums are paid under an insurance contract, the insurer assumes the risk. Insurance makes available funds necessary to repair damage or rebuild shortly after a disaster event. Business interruption insurance can help companies and their employees survive the recovery and rehabilitation period. Insurance costs for certain categories of buildings or uses, however, may be unaffordable, and coverage for some categories of natural hazards may be unavailable.
- ***Public asset coverage.*** Most public assets are not covered by insurance. Funds for rebuilding damaged assets, therefore, must come from annual budgets or external sources. This puts great pressure on public budgets in the post-disaster period when economies are often particularly weak, as typically little has been set aside for budget self-insurance purposes. Insurance coverage for critical public assets will ensure that key infrastructure can be rebuilt or rehabilitated quickly if damaged in a hazard event. Selection of assets that merit insurance coverage should be based on careful prioritization of public facilities and on comprehensive facility vulnerability assessments.
- ***Risk pooling and diversification.*** Insurance costs for geographically concentrated or relatively homogeneous groups or facilities are often high, due to the potential for simultaneous damage to all members of the group or category. Diversification of the risk pool, through banding with others from separate areas or industries can result in reduced insurance premiums for all participants.
- ***Risk financing.*** Risk financing mechanisms allow losses to be paid off in the medium- to long-term via some form of a credit facility. Alternative risk financing mechanisms provide cost-effective, multi-year coverage that assists with the stabilization of premiums and increases the availability of funds for insurance purposes. Examples of such mechanisms include risk capitalization, credit backstop facilities and finite insurance mechanisms.

C. Risk Management Actors

Natural hazard risk management actions must be taken at many different levels simultaneously to achieve maximum effectiveness. Currently, most existing risk management activities and programs in the Caribbean are undertaken at the national level, coordinated by the designated national disaster office. As governments, private-sector enterprises, communities and individuals repeatedly suffer losses and attempt to recover from the effects of natural hazards, a broader range of groups and organizations have become actively involved in hazard risk management in the region. For particularly vulnerable communities, decisions that can be made and actions taken close to the individual- and community-level have more immediate and significant effects than do more distant ones. Often, however, appropriate expertise, decision-making power, organizational mechanisms and economies of scale require actions and decisions to be taken at the sub-regional and regional levels in areas such as hazard mapping, vulnerability assessment and building code implementation and enforcement. This section describes the range of individuals, agencies and organizations that are, or should be, active in the management of hazard risks in the region.[12]

1. Local level

At the local level, civil society (individuals, the private sector, the labor sector, political parties, academics and other non-governmental actors and organizations), local disaster committees and, where existing, local governments can play important roles in hazard risk management. Many local organizations and groups serve communities, often focusing on specific geographic areas. Churches, service organizations, school-related groups and sports clubs can serve as information conduits, provide mutual support for members and neighbors and identify practices and developments that increase or

[12] A detailed review of the existing risk management activities in the region, organized by agency, can be found in the *Caribbean Disaster Management in the Caribbean: Baseline Study.*

decrease hazard vulnerability. Local businesses serve the needs of the community and provide critical employment. Where they exist, local media outlets, such as newspapers and radio stations, can provide appropriate information, tailored to the community, and serve as an important voice of the community. All parts of civil society also play a strong role in risk management at the national and regional levels.

Box 3: Dominican Republic: Community involvement in reducing risks

In the Dominican Republic, the Asociación Dominicana de Mitigación de Desastres (ADMD) and a coalition of NGOs have championed disaster preparedness and prevention among the most vulnerable communities, conducting workshops in over 700 communities since 1995. In these workshops, local participants prepare a community emergency plan, which is built on an assessment of local hazard vulnerabilities and of locally available resources to address those vulnerabilities. During hurricane Georges (1998), communities that had established emergency committees through this program successfully evacuated people from flood prone areas, established shelters, organized clean-up brigades, and requested and distributed assistance without incident. In addition, these communities have identified and implemented small risk reduction projects and actions. Projects, such as the construction of containment walls and drainage ditch embankments, are designed to address local health and environmental contamination problems as well as reduce and mitigate the constant floods and landslides, which are a daily concern for these communities. The positive effect of these initiatives was demonstrated by the reduced impact of hurricane Georges on the participating communities.

Most national disaster and emergency management organizations in the region support a network of local disaster committees. These committees implement, in coordination with other local groups, the activities of the national disaster organization, such as local shelter management, and inform national disaster policies and actions through local disaster management planning. Local governments, where they exist and function, must be given the ability to guide local hazard risk management efforts through policies which encourage local participation and through the provision of technical assistance to local groups.

2. *National level*

Nationally, central governments, including their disaster offices, are in a strong position to guide and coordinate hazard risk management. National-level planning and sectoral agencies develop and implement national government policies and programs. Both long-term planning activities and the day-to-day workings of the national government can significantly increase or decrease the current and long-term vulnerability of a country to natural hazards. National disaster offices (NDOs) are responsible for developing and implementing disaster preparedness, response and recovery efforts at the national and local levels. NDOs must also serve as the major champion of hazard risk management initiatives. However, most hazard risk management actions and programs, by their nature, must be implemented by the sectoral agencies and organizations responsible for the infrastructure, assets, programs and individuals involved.

Private companies and their organizations—chambers of commerce, business and trade associations and standards organizations—control the majority of the businesses and assets that make up a country's economy. Their decisions on how to invest, build, maintain and insure these assets have a significant effect on how well a country's economy can weather and recover from a natural hazard event. Indigenous financial institutions provide the funding for most local construction and development activities and, therefore, have the potential to contribute significantly to risk management through their lending

Box 4: Natural Hazard Risk Management in the British Virgin Islands

Disaster Management in the BVI received a shot in the arm following the traumatic effects of Hurricane Hugo on the physical and socio-economic fabric of the country and on the psyche of the people in September 1989. Losses from Hurricane Hugo amounted to US$40 million and 30 per cent of the country's housing stock was destroyed. The Government recruited regional disaster management professionals for advice and to strengthen the country's technical capacity for disaster management. A 1993 post-Hurricane Hugo Assessment Study commissioned by PAHO focused on sustainable development issues and recommended specific mitigation measures and an approach to integrating disaster mitigation into the country's development process.

Hurricane Hugo prompted a new approach. To a large extent, the experience of Hugo was the catalyst for introduction of an administrative, operational and policy framework to reduce the impacts of future hazard events. The post-Hurricane Hugo Assessment Study also represented a departure from the traditional approaches to disaster management that focused on response and recovery and shifted the emphasis to mitigation. The Study informed all subsequent work on hazard assessment and disaster mitigation in the BVI, including the 1997 Hazard Risk Assessment, the 1999 Building Regulations, revised development standards, environmental protection measures and the current Mitigation Strategy that was recently submitted to Executive Council for its approval.

Under a UNDP/UNCHS project initiative a draft National Physical Development Plan for the BVI was started in 1992. As part of the plan preparation process the need for detailed information on hazard risks facing the country was recognized. This culminated in the completion of a comprehensive Hazard and Risk Assessment Study for the territory in 1997. The Study identified and mapped all major hazards affecting the territory.

Strong Political Support for Hazard Risk Management. Disaster management and mitigation in the BVI has also benefited from the strong political support of the territory's Governor and Deputy Governor who have demonstrated a keen understanding of relevant disaster issues and what is required to address them and are willing to champion the cause of disaster management and mitigation. Successive Chief Ministers have also provided financial and political support for disaster management. Furthermore, the BVI can afford to and does invest heavily in implementation of disaster mitigation measures, strengthening institutional capacity and manpower development and training.

Public Awareness. Much emphasis has been placed on public awareness and education with respect to disaster management and mitigation. The aggressive approach of the national disaster agencies paid dividends and this is reflected in the high level of consciousness among residents of the need to adopt appropriate hazard resistant construction techniques. It is estimated that almost 100% of new buildings are equipped with hurricane shutters, which are exempted from government taxes—a practical example of government's commitment to disaster mitigation. Local industries also manufacture shutters, making them easily available locally and for export to other Caribbean islands.

The BVI experience also highlights the importance of an integrated approach to disaster management at the institutional level. Collaboration between the Physical Planning Department, Development Planning Unit and the Department of Disaster Management resulted in development of a framework for incorporating disaster management and mitigation into physical and economic planning.

standards and policies. Business and industry actors play a central role in risk management at all levels—local, national and regional. Links to other businesses, both nationally and internationally, through trade associations and business transactions, provide businesses with access to tested and appropriate risk management practices.

3. *Sub-regional and regional levels*

The small size and similarity of legal and political frameworks of many of the countries of the region provide arguments and opportunities for collaboration at the supra-national level. Many of the institutions and structures necessary for such coordination already exist. The secretariat and specialized agencies of the Organization of Eastern Caribbean States (OECS) provide assistance to member countries, which can contribute to hazard risk management within the sub-region. Development of appropriate model legislation, harmonization of existing legislation, collaboration on financial issues, such as risk pooling, are examples of appropriate actions that can be taken at the sub-regional level to advance hazard risk management.

Similarly, regional institutions can play an important role in facilitating adoption of appropriate risk management practices by member countries and organizations. CDERA is the CARICOM agency with the mandate for emergency response and hazard risk management in the region. Many other organizations, both private sector and inter-governmental, must contribute to regional hazard resilience, by furthering hazard risk management measures within their own sectors. For instance, CARILEC has participated in the development of a manual for hazard mitigation in the electrical utility sector and could serve as a powerful conduit for guidance and advocacy for risk management in this sector. The CDB has become an important component of a regional hazard risk management strategy, through the development of its natural disaster management strategy and the recent establishment of the DMFC.

4. *Multilateral and Bilateral Lending Institutions and Development Partners*

Multi- and bi-lateral lending institutions and donors can affect the vulnerability of the region to natural hazards through their lending and grant programs. Although funds from donor agencies for post-disaster reconstruction and response are diminishing, international donors continue to be seen by many countries as the prime insurer of natural catastrophe risk. In an effort to change this perspective and to promote better hazard risk management in the region, a number of donors have supported broad hazard mitigation projects and initiatives in the region over the past decade. These focused risk management interventions must be reinforced by the incorporation of risk management measures into all funded activities. Appraisal of hazard risk, through mechanisms such as natural hazard impact assessments, and identification and implementation of appropriate risk management interventions must be incorporated into standard project development and approval processes.

By coordinating efforts and taking explicit steps to ensure that funded projects are appropriately located and constructed and by supporting related institutional capacity building, financial and donor institutions at all levels can contribute significantly to overall hazard risk management in the region.

D. Hazard Risk Management in the Caribbean : Main challenges

1. *Identifying good practices*

To identify appropriate actions, agencies and levels of intervention for hazard risk management in the Caribbean, a study of risk management practices in the region was undertaken as a foundation for this report. The first step in this process was to review existing risk management practices and select appropriate or "good" activities. Activities were identified as good practices, based on tangible, measurable outcomes, the capability of replication and the appropriateness for use within the Caribbean. In addition to their use within this report, the identified risk management good practices are intended to provide guidance and information for individuals, governments and organizations on useful risk management interventions.

The review process considered the principal dimensions of natural hazard risk management (risk identification, risk reduction, and risk transfer) and appropriate levels (local, national, region) for

implementing the identified practice. Using the resulting good practices as a yardstick, actual management practices and gaps were assessed in Antigua and Barbuda, the British Virgin Islands, Dominica, the Dominican Republic, Grenada, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, as well as in the OECS sub-region and the CARICOM region. For each of these assessments, actual practices and gaps were summarized in separate matrices for risk identification, risk reduction and risk transfer activities. The findings from the good practices inventory and the actual practice assessments are presented in detail in the Technical Annex to this paper. Below are the main results of this assessment.

2. *The Caribbean experience in risk management: opportunities and constraints*

There is a variety of knowledge and experience with hazard risk management within the Caribbean, but this knowledge and experience, for the most part, is not well developed, has not been widely shared and is currently not effectively incorporated into mainstream development decisions in either the public or private sector. The main reasons for this gap are:

- The continued perception that risk management is the sole province of the national agencies responsible for disaster management has hindered the incorporation of risk management measures into the work programs and agendas of those responsible for most of the assets at risk, namely the sectoral agencies, trade associations and private companies.
- Public demand for risk management measures is currently limited, due to factors such as complacency, ignorance of risk and the perceived cost of those measures. There is also a clear need to stimulate public demand for hazard risk management, through visible and persistent advocates, combined with incentives for adoption of appropriate practices.
- With some exceptions, successful examples or pilot activities are often not well known outside of the community or country in which they were carried out. Too often, documentation of those successful examples is either unavailable or inaccessible, because of overly technical language or inadequate distribution. User-friendly documentation of successful approaches, including distillations for use by decision makers, is essential for the sharing of successes. Mere provision of hazard information, however, is not sufficient to effect change in hazard risk management practices in the region.
- Until recently, there has been no overarching strategic framework to enable broad collaboration on hazard risk management across the region. Duplication of efforts has resulted from a lack of coordination among governments, regional and international agencies and organizations and donor and multi-lateral lending institutions. Development of the comprehensive disaster management strategy for the region and establishment of the DMFC at the CDB are important steps to address this gap. The lack of standards and common methodologies for hazard, vulnerability and environmental impact assessments, however, limits the potential for development and sharing of regional expertise in these arenas.
- Coordination of risk information and promotion of risk management measures between governments and businesses and industry organizations are lacking. Although large businesses understand the need for this information and include hazard considerations at some level of their investment decisions, several multi-national businesses have suffered significant losses from recent natural events. Small businesses often have neither the understanding of hazards nor the capability to incorporate this information into their business plans. A formal public-private effort is needed to ensure that information is shared and that business investments include appropriate risk reduction measures.
- Finally, many significant risk management measures and controls are already in place, for development control, building standards and environmental protection. A lack of the political will by governments, private sector entities, donor agencies and lending institutions to insist on adherence to those standards, however, render these important measures largely ineffective.

Good risk management practices and examples of successful implementation of those practices have been identified and documented through this study. For each area of intervention, appropriate activities are

identified and described, shortcomings in existing practices are highlighted and recommendations are given. These interventions are presented in the following categories:

A. Ensuring Coordination of Activities and Participation by All Sectors, Public, Private and International Actors

B. Developing Common Methodologies, Tools and Regional Expertise

C. Collecting, Mapping and Disseminating Hazard Information

D. Assessing Vulnerability

E. Ensuring Safer Construction: Building Codes and Standards

F. Improving Physical Development Planning

G. Developing Risk Transfer and Financing Mechanisms

III. Towards a Caribbean Framework for Hazard Risk Management

A. Ensuring coordination of activities and participation by all sectors and actors

1. Regional initiatives

Two new regional initiatives, the proposed strategy for comprehensive disaster management (CDM) in the Caribbean and the establishment of the Disaster Mitigation Facility for the Caribbean (DMFC) within the CDB, have the potential to dramatically improve coordination and integration of risk management activities in the region. These regional initiatives must be complemented by coordinated public- and private-sector risk management activities at the national level, and supported by multilateral lending institutions and bilateral development agencies.

Box 5: The St. George's Declaration: Coordinating Action in the OECS

The member territories of the Organization of Eastern Caribbean States (OECS) have adopted the *St. George's Declaration of Principles for Environmental Sustainability in the OECS*, which includes strong support for hazard risk management in the region. Under this declaration, the Governments of the OECS have committed to strengthening hazard risk management by establishing appropriate frameworks at the local, national and regional levels and by exchanging hazard and risk management information and experiences. The St. George's declaration also provides a framework for integrating hazard risk management with other priority environmental and development issues in the OECS region, including environmental education, pollution control, sustainable natural resource use and promotion of science and technology.

In 2001, a working group representing regional and national disaster management organizations, the private sector, regional technical institutions and multi-/bi-lateral donors and lending institutions developed a proposed *Strategy and Results Framework for Comprehensive Disaster Management in the Caribbean.* This strategy was developed through a series of national and regional consultations and was undertaken with the objective of integrating comprehensive disaster management (CDM) into the development processes of the Caribbean Disaster Emergency Response Agency (CDERA) member countries. This strategy framework is intended to focus and direct the region's risk management interventions and to highlight synergies between existing activities, programs and institutions within the region. The proposed CDM strategy emphasizes risk reduction, while incorporating the other components of disaster management, including preparedness and response activities. Within this framework, the institutional capacity and role of the CDERA, the CARICOM agency responsible for disaster management, to serve as the driver and promoter of CDM at the regional level would be strengthened. To this end, CDERA's mandate and activities are being expanded to include broader risk management activities with a view to identifying gaps, targeting interventions and capacity building, and coordinating activities for risk management. At the national level, consultations are being held to encourage

governments to develop national strategies within the CDM framework and to identify champions for hazard risk management at the ministerial level and within the private sector.

Also in 2001, the Caribbean Development Bank established the *Disaster Mitigation Facility for the Caribbean (DMFC).* The objectives of the DMFC are (a) to assist the member countries of the CDB with the adoption and institutionalization of successful disaster mitigation policies and practices and (b) to strengthen the CDB's capacity to effectively implement its 1998 Natural Disaster Management Strategy and to institutionalize disaster management into CDB policies and programs. The establishment of the CDB DMFC marks an important step towards the promotion and coordination of risk management within the region. The CDB supports agencies and organizations across a broad range of activities and sectors, including poverty reduction, infrastructure development and environmental management, placing it in a strong position to promote and coordinate risk management activities in sectors that have not traditionally been directly involved in hazard risk management. While the initial focus of the DMFC will be on incorporating hazard risk management into the internal operations of the CDB and its borrowing member countries, it provides a critical regional forum for broad-based hazard risk management within the economic and development planning sectors. The DMFC has committed to assisting other regional organizations to better define their roles and to strengthen their capacities for hazard risk management.

Sub-regional and regional sectoral agencies and associations also have the capacity for assisting their members with hazard risk management. Examples include hurricane-related risk reduction in the tourism industry, facilitated by the Caribbean Hotel Association (CHA), and vulnerability reduction in the electrical utilities, with support from the Caribbean Electrical Utility Association (CARILEC). Coordination of risk management activities within sectors across the region is beneficial and cost-effective, given economies of scale, the availability of expertise and the access to public- and private-sector decision makers through these organizations.

2. *National Initiatives*

At the national level, it is the sectoral ministries, and not the National Disaster Offices, that are best placed to implement hazard risk management measures. While disaster offices are mandated to prepare for and coordinate the response to disaster events, it is the individual sectoral agencies that develop the policies and programs, and direct the infrastructure and development investments that affect the actual levels of vulnerability to natural hazards. Improper management approaches in key sectors, such as agriculture, forestry and fisheries, can degrade natural protective systems, resulting in increased disaster impacts. Improper development practices, such as building in flood plains or unstable slopes, threaten environmental quality and exacerbate hazard effects. Similarly, lower-income settlements and disadvantaged populations are often more vulnerable to natural hazards than the population at large.

Government actions should be guided by a comprehensive national risk management framework and overseen by a high-level, multi-sectoral coordinating council. The national consultations currently being conducted as part of the regional comprehensive disaster management strategy are designed to develop these national strategies and to build institutional support for implementation.

Box 6: Multi-sectoral Risk Management Coordination in St. Kitts and Nevis

The Government of St. Kitts and Nevis has established a National Disaster Mitigation Council to coordinate and promote integrated management of hazard risk. This council reports directly to Cabinet and is chaired by the Deputy Prime Minister. Its membership represents a wide array of participants, both public and private, including the heads of each Government Ministry and Department and representatives of the national disaster agency, the Chamber of Commerce, the Hotel and Tourism Association, protective services, church and women's organizations. This high-level body has raised the profile of hazard risk management throughout the country and has provided critical political support for risk management initiatives in St. Kitts and Nevis.

Selected sectors, such as tourism, are also increasing risk management efforts, often coordinated by regional trade organizations. Such risk management activities, however, rarely address hazard-related issues and concerns that are outside the boundaries of an individual facility or physical plant, such as the vulnerability of key public infrastructure serving the site.

3. *Private Sector*

Business, industry and private-sector organizations can complement and strengthen public-sector risk management activities and programs. Businesses rely upon governments to set proper building standards, but they can also provide powerful incentives for compliance through measures such as mortgage requirements, insurance premium reductions and "seal of approval" programs for good practices. Similarly, businesses and industry typically provide the materials and expertise required to implement risk management efforts. In addition to functioning facilities and public utilities, businesses also require human capacity to function. If, after a disaster event, employees are unable to return to work, due to injuries, damage to their homes or inaccessible roads, businesses themselves will not be able to reopen. Support for national home strengthening and health programs to reduce the vulnerability of the population generally to natural hazards will, therefore, assist with business continuity in the post-disaster period.

In most countries in the region, private-sector interests are represented in the national disaster and risk management structures, but private- and public-sector hazard risk management efforts are not well coordinated. Tight, and in places over-saturated, markets have limited the offering of incentives for appropriate risk management actions, such as insurance premium reductions. Nonetheless, at least one regional insurance company is offering incentives, in the form of premium reductions, for buildings constructed or retrofitted with hazard-resistant building techniques. Comprehensive vulnerability assessments of private facilities are rarely undertaken and where they are conducted, typically they do not include off-site considerations, such as transportation access and public services.

Several business and industry associations include modest programs to reduce vulnerability. However, these programs are not well supported by their members and receive little external assistance. A consolidated effort among these organizations,[13] training and management support for risk management and a structure for formal cooperation with governments and international financial institutions could yield broader results.

4. *Multilateral and Bilateral Development Agencies*

Organizations such as USAID, the European Union, CIDA, UNDP, CDB, the OAS and the World Bank have supported a variety of hazard risk management initiatives in the Caribbean over the past decade. Little coordination between their efforts has taken place, despite the existence of multiple fora for donor and project coordination. A major obstacle for collaboration on long term risk management has been the traditional focus on specific hazard events by coordination mechanisms, such as the Eastern Caribbean Donor Group for Disaster Management. This group, however, has recently agreed in principle to a sustained focus on long-term hazard risk management. This precedent can be significant for the entire region, since the donors represented on this body are typically active throughout the wider Caribbean. Other donor groups that have been convened to address specific issues, such as poverty and environmental management, can also assist with institutionalizing risk management in their work programs.

Assessments of hazard risk and incorporation of risk management measures in proposed investments must be consistently applied, using similar approaches and reference standards, as part of project development in all donor and lending agencies. This is especially critical for key infrastructure and high-profile, time-sensitive issues, such as post-disaster reconstruction. Multi- and bi-lateral donors and lending agencies,

---

[13] For example, the Caribbean Hotel Association (CHA), Caribbean Tourism Organization (CTO) and Chambers of Commerce and Industry.

however, have often been unwilling to require adherence to appropriate development standards when funding new infrastructure and local development programs. Reticence to impose such standards has stemmed from a desire to avoid conditionalities, which may hamper the disbursement of loan funds, or in deference to local practice. The CDB DMFC is a good example of a positive approach. The medium to long-term objective of the DMFC is to fully incorporate disaster issues into the project development cycle at the CDB and its national development bank partners. To be effective, however, other donors operating in the region will need to follow a compatible approach. In addition, all donors should assess capacity building needs in regional and national agencies to support their projects.

Recommendations

- Integrate hazard risk management into development decision-making through planning and budgeting, with emphasis on the impacts of decisions and resource allocations on low-income communities.
- Provide financial and institutional support for the proposed CDM strategy and the newly established CDB DMFC as critical mechanisms for coordinating regional risk management activities and important frameworks for building capacity for hazard risk management within regional sectoral agencies, business and industry associations and community-based organizations.
- Incorporate hazard considerations and risk management measures into the activities and work programs of all sectoral government agencies and of private enterprise.[14]
- Donor agencies active in the region adopt and apply consistent hazard risk management policies, and offer institutional capacity building as an important component of their assistance programs to governments and regional organizations, including the private sector.[16] These common approaches can be coordinated through existing mechanisms such as the Eastern Caribbean Donor Group and other similar donor coordination groups.

Box 7: UWI Seismic Research Unit: A Regional Hazards Center

The Seismic Research Unit (SRU) of the University of the West Indies is an existing regional center of hazard expertise that provides monitoring, assessment and mapping assistance at national and regional levels for seismic hazards.

The SRU disseminates the results of its monitoring and assessment of earthquake, volcanic and tsunami hazards through counterparts, such as national disaster agencies, and its web site.[15] Recently, with the support of USAID, the SRU has developed educational materials on Caribbean geologic hazards for use throughout the region.

B. Developing Common Methodologies, Tools and Regional Expertise

Similarities in political systems and geography in the Caribbean provide strong cost and capacity building incentives for development of common regional tools and expertise. Various levels of experience are currently available in the region in all of the fields that contribute to risk management, including hazard assessment and mapping; economic, social and physical vulnerability assessment; engineering and building practices; insurance; and policy development. Rarely, however, are all of these capabilities available at the national level, nor do they need to be. Regional institutions possess or can leverage expertise that is often not available at the national level.

Over the past decade, a number of regional model policies and legislation for hazard-related legislation have been developed. The OECS/NRMU has incorporated risk management components in model physical planning and building standards. CDERA has developed model disaster legislation, which

---

[14] See *A Strategy and Results Framework for Comprehensive Disaster Management in the Caribbean* (CDM) IR-3.2: "Organizations representing key economic sectors actively promote CDM to their constituents and on their behalf."

[15] http://www.uwiseismic.com/

[16] CDM IR-3.1: "Donors to the region have adopted consistent policies requiring due attention to hazard assessment and mitigation measures in project approval."

incorporates comprehensive disaster management approaches. CIDA, the World Bank and the OAS are introducing a risk management approach to adapt to the consequences of climate change, as part of the new regional project, "Mainstreaming Adaptation to Climate Change" (MACC). These models provide important guidance and assistance to national governments embarking on comprehensive risk management programs. They also advance the harmonization of regional policy and legislation, which facilitates collaboration and sharing of expertise between countries and at the regional level. While progress has been made in adapting and adopting legislation based on regional models, significant assistance is still required to develop the necessary administrative mechanisms for implementing these programs nationally.

Building upon the proposed CDM strategy and the activities of the CDB DMFC, there is a need for developing regional risk management tools and expertise and for identifying appropriate entities for building capacity to manage hazards within the Caribbean. The remaining sections of this paper include reviews of opportunities for developing or expanding appropriate models, tools and expertise for hazard risk management within the region, through hazard mapping, vulnerability assessment, physical development planning and risk transfer activities.

Recommendations

- Review the capability of regional and sub-regional institutions to provide technical assistance for hazard assessment and risk management. Determine appropriate regional centers for hazard risk management expertise and provide support to these centers for providing this expertise.
- Establish a clearinghouse of information on available resources and expertise at the regional level, possibly with the support of the CDB DMFC and by expanding CDERA's existing database of human resources.
- Support and expand existing clearinghouses for hazard risk management information, such as the Regional Disaster Information Center for Latin America and the Caribbean (CRID) and the Caribbean Disaster Information Network (CARDIN) information centers.

C. Collecting, Mapping and Disseminating Hazard Information

Knowledge of hazard risks and opportunities to minimize those risks gives individuals, communities, businesses and governments the power to choose—within their means—the level of hazard risk that they will accept. Identification of existing and potential hazards and vulnerabilities is a prerequisite to the development of programs or actions to reduce their impact. While merely providing information on hazard risks is insufficient to ensure proper management of those risks, maps of areas subject to hazard effects are necessary to make appropriate decisions for reducing hazard risk in designing and locating new developments, settlements, infrastructure and investments; to prioritize hazard risk management interventions; and to prepare disaster preparedness and response plans.

Producers and users of hazard information represent distinct groups. Hazard information and maps are typically produced by individuals and agencies with technical expertise in particular hazards, generally associated with regional and national technical agencies and regional universities. Hazard map users comprise a much larger and more diverse group, representing both managers and technicians from any agency, business or community affected by natural hazards. The requirements of both groups must be considered in developing and applying hazard information.

1. Production of hazard information

- **Existing situation : hazard information is insufficient and difficult to use**

Selected hazard maps are available in many countries in the region, but rarely do they address the full range of existing hazards, nor are they typically at a scale that is appropriate for use at the local or community level. Existing hazard information and maps, such as the landslide hazard maps prepared by

the OAS for several of the OECS countries, were often prepared in response to a specific hazard event. Integration of such maps into a multi-hazard database with other maps prepared at different times and for separate purposes is difficult.

- **First objective : hazard mapping procedures coordinated regionally**

Most countries in the region do not have, nor do they need, full hazard mapping and assessment expertise. At the regional level, coordinated hazard mapping procedures and mechanisms need to be established to expand the availability of hazard maps and information, to capture new geographic and hazard information that is produced as part of separate public- and private-sector projects and to ensure that maps and information generated from distinct activities can be easily integrated. Most hazard assessments are currently carried out by consultants from outside of the target country or the region. Since much of the existing hazard mapping expertise within the region resides at regional technical institutions and universities, a regional-level technical support and capacity building mechanism should also be considered to facilitate the further development and application of existing expertise within these institutions. The CDB, through its DMFC, has committed to facilitating the strengthening of regional hazard professionals. The proposed CDM strategy also promotes the establishment of a regional skills bank[17] and the strengthening of regional research and data partners.[18]

- **Second objective : local capacity and participation improved**

To complement the regional expertise, national and local capacity for translating, applying and updating hazard information must be strengthened. As part of any national or regional hazard mapping activity, appropriate national technical agencies, such as environment, water resources, disaster and agriculture, should be trained to explain the hazard assessment results and to maintain and update hazard information as local conditions change.

Individuals and communities can play an important role in ensuring the accuracy and currency of environmental and natural hazard information. They are closest to hazard sources, most directly affected by their impact, and often best situated to monitor development, environmental changes, and other factors contributing to hazard vulnerability. Often, however outside experts often fails to adequately solicit and incorporate local hazard knowledge in their assessments. Common regional standards and training for hazard assessment and mapping must include provisions for capturing critical local hazard information. When available, information and databases from business and industry, such as insurance claim databases, can provide important additional details for such assessments.

- **Third objective : comprehension and use of hazard maps made easy**

For hazard assessments and maps to contribute to risk management efforts, their results must be understandable and useful. Important findings of many hazard assessments are currently overlooked due to the technical nature of the reports and maps produced. Users of hazard information need results presented in an accessible format at an appropriate scale, and map legends should include information that is relevant to the country or community. To meet these needs, hazard assessments and maps must be designed and conducted from inception to address the full range of users' needs.

Recommendations

- Develop a common set of hazard assessment methodologies and mapping standards for use in the region. The CDB DMFC is considering undertaking such an effort, in coordination with appropriate regional institutions. Hazard assessment methodologies should include provisions for incorporating

---

[17] CDM IR-2.1 #1: "Establish a regional skills bank to support NDOs in assessing needs and identifying existing regional capacity."

[18] CDM IR-1.3: "Other research and data partners in the region are strengthened and rationalized to support CDM." and CDM IR-2.2: "Regional research and technology institutions have established capabilities including access to the latest technologies in hazard assessment, mapping and warning systems."

local and community-based knowledge of hazards[19] and for regular updates of the hazard information. The design of hazard maps should take into consideration the full range of map users, from technical agencies through policy makers and community groups.

- Support regional-level capacity for hazard assessment and mapping through the identification and strengthening of regional centers of expertise for all prevalent hazards. Regional organizations and multi- and bi-lateral lending institutions and donors should contribute to the development of these regional centers of hazard expertise by making provisions for these responsibilities in annual budgets and by using the identified centers in funded hazard assessment activities.
- Incorporate training and capacity building for understanding, translating, applying and maintaining hazard information and maps at the national and local levels into all hazard assessment and mapping activities.

2. Sharing and communicating hazard information

- **Why share?**

The success of hazard mapping initiatives in the region has often been judged, inappropriately, solely on the production of hazard maps, rather than on the impact of the information produced. To enable the use and application of hazard information for hazard risk management, efforts to produce accurate and useful hazard information must be complemented by appropriate mechanisms for sharing and communicating hazard assessment results.

Currently, where hazard information does exist, it is often not shared with those affected. The right to know such information in a useful form is central to enabling decision makers at all levels to manage their risks. Government agencies are often reluctant to release such maps, or have difficulty accessing them for their own uses. At times, hazard information has been concealed, with the concern that full disclosure of risks will jeopardize investments. Typically the contrary is true, however, where good quality information speeds rather than inhibits investment.

Business and industry require accurate hazard information to make decisions about business locations and operations. It is in their best interest to ensure that their own assets, and the public infrastructure on which they depend, are resilient to natural hazards. Management of these risks to ensure business continuity in the face of natural hazards requires the identification of hazardous areas and vulnerable facilities and the consistent use of this information in business decisions. However, little hazard information is currently available to business and industry for risk management decisions. Their decisions regarding development in hazardous areas, such as low-lying coastal locations, are typically dominated by economic factors and not fully informed on hazard risks. Hazard information collected in national and regional clearinghouses should be made available to business and industry and other private-sector representatives. Business and industry associations and representatives can also play an important role in bringing the proper attention and understanding to hazard information. In Jamaica, for instance, the Institute of Engineers has conducted public training sessions on natural hazards.

Box 8: Grenada: Open Access to Hazard Information

Prompted by substantial attention to Kick 'em Jenny, a submarine volcano off the north coast of Grenada, the Government of Grenada has recently begun to make public all information on the volcano and on other hazards. By releasing information outside the context of a hazard event, the government is able to promote awareness of existing hazards, publicize available hazard maps and demonstrate that it has nothing to hide. This open access to hazard information also strengthens public support for expansion of the existing hazard database.

[19] CDM IR-2.3: "Research is applied to specific local circumstances and information on hazards, vulnerabilities and protective measures is widely available."

- **How to disseminate and educate?**

Creating hazard information collection and distribution centers. To facilitate the use and application of hazard information, a clearinghouse mechanism needs to be established in each country, ideally at a central planning level. Such a mechanism would store, integrate and distribute hazard information that is collected from, and shared with, a wide range of agencies and sectors. Broad access to hazard and base data information should be a central feature of any such clearinghouse, to support appropriate development and investment decisions. Regional centers of hazard expertise, such as specialized faculties of the University of the West Indies, should maintain and make available complete databases of hazard information and maps produced. The CDB DMFC has also committed to facilitating such regional stores of hazard information.

A number of countries in the region are developing comprehensive land information systems, which incorporate available hazard information. Such multi-purpose databases facilitate the use of hazard data in broader development and environmental management efforts. Jamaica, through its National Environment and Planning Agency (NEPA), has developed natural resource and hazard databases, which are available for all of its planning and management activities through a common geographic information system (GIS) database. St. Kitts and Nevis has recently compiled a multi-hazard map database,[20] which is being used by the Physical Planning Department in the development of a National Land Policy. Typically, however, physical development plans are produced without the benefit of critical hazard information.

Box 9: Hurricane Hazard Information for Caribbean Coastal Construction

The Engineering Faculty at UWI/St. Augustine recently participated in development of the *Hurricane Hazard Information for Caribbean Coastal Construction,*[21] a web-based database of storm hazard information for the wider Caribbean. Through this application, individuals and agencies involved in the coastal zone can generate reports on wind, wave and surge hazards for various return periods. This information is designed specifically to support the use of statistically based storm hazard information in coastal infrastructure engineering design. It is also being used by UWI to support coastal engineering projects and curricula.

Educating potential hazard victims. Once hazard information has been developed and made available, developers and custodians of the hazard maps should conduct outreach and education sessions for those affected by the hazards. The purpose of such efforts is to build awareness of the hazard and to assist with proper use of the information for risk management. A number of examples of successful uses of community-level hazard maps exist in Jamaica. In Portland, Jamaica, local hazard maps were developed and residents were trained on their use. The University of the West Indies/Mona is developing atlases of small communities, to provide information for use when buying or building homes. In Saint Lucia, the physical planning department is developing maps for use by local communities. The effectiveness of these community-based efforts should be analyzed and replicated, as appropriate.

Incorporating information on hazards and hazard risk management into school curricula at all levels has the potential to dramatically increase knowledge of and attention to hazard issues. As part of its ongoing work program, CDERA is facilitating the development of hazard information for primary and secondary schools. A regional working group already exists for coordinating these activities at the tertiary levels. The proposed CDM strategy advocates for stronger links between national and regional education institutions and hazard risk management in the region.[22]

---

[20] See www.oas.org/pgdm/hazmap.htm.

[21] Developed under the USAID/OAS Coastal Infrastructure Design, Construction and Maintenance Training Program.

[22] CDM IR-2.1: "Curricula and programs at regional and national educational institutions support hazard management and links to environmental management."

Recommendations

- Establish central clearinghouses at the national level in each country to store, integrate and distribute hazard information. These clearinghouses should assist central development planning functions, while also supporting broad access to the information At the regional level, comprehensive databases of hazard information and maps should be maintained by designated centers of hazard expertise. At both the national and regional levels, clear policies promoting the sharing and use of hazard information broadly within both the public and private sectors should govern these clearinghouses.
- Develop models for outreach to community groups and for private- and public-sector education on hazard maps and information and incorporate these models into all hazard assessment activities in the region.
- Adapt available hazard information for use in school curricula at all levels.

D. Assessing Vulnerability

Vulnerability assessments of the built environment provide essential guidance for prioritizing maintenance and upgrading works as well as for determining safe uses for infrastructure and facilities. Similarly, assessments of social, economic and environmental vulnerability determine the resilience of population groups, settlements, key assets and environmental systems to hazard effects. Vulnerability assessments should be undertaken in particular for lifeline infrastructure, such as medical facilities, emergency shelters and public safety agencies, to ensure the safety of the public and the continuity of public infrastructure during and after hazard events. Too often, uses for public buildings are designated for specific uses without knowledge as to whether the selected buildings can safely support such uses.

Box 10: Assessing Vulnerability to Save Lives

Vulnerability assessments have been used in the Caribbean to guide critical decisions concerning the safety of residents:

- Assessments of buildings designated as **emergency shelters** in the British Virgin Islands and in Antigua/Barbuda have identified structures that should no longer be used as shelters due to safety concerns.
- Despite their critical role in protecting children and, often, as emergency shelters, many **school buildings** throughout the region are at risk to hazard-related damage. School vulnerability assessments and risk management activities have been undertaken throughout the region, including Antigua/Barbuda, Dominica, Grenada, St. Kitts/Nevis and St. Lucia.[23]

1. How to prepare a vulnerability assessment ?

In vulnerability assessments, hazard maps and information are combined with detailed information on the location and characteristics of the resources and population at risk. A first step towards a vulnerability assessment is the development of a comprehensive inventory of existing critical facilities and resources within the assessment area or sector. Examples of such inventories include databases of key infrastructure or of all hotels, guesthouses and tourist infrastructure. Once compiled, these inventories can be used for ongoing management purposes as well as for conducting vulnerability assessments. The vulnerability of an existing structure or development is largely determined by the original location and design and by ongoing maintenance practices. Consequently, inventories must include the location of the resources, as well as information necessary for facility maintenance and safety, such as copies of building plans. Infrastructure inventories should cover both public and private assets, as appropriate, as critical national facilities, such as ports, electrical utilities, telecommunications infrastructure and airports, are increasingly owned and managed by private entities.

In most countries, comprehensive databases of critical infrastructure do not exist, nor does important supplementary information. In Antigua and Barbuda and St. Kitts and Nevis, databases of critical public

[23] With funding from USAID and ECHO. See www.oas.org/cdmp and www.cdera.org.

infrastructure were recently developed to conduct vulnerability assessments. Building plans, which are necessary to determine central structural characteristics for use in the vulnerability assessment and for ongoing maintenance, were not available for the majority of the facilities reviewed.

Currently, no standard methodologies for vulnerability assessment exist for the Caribbean. Vulnerability assessments that have been undertaken have focused primarily on the built environment, in particular on public facilities, schools and shelters. Little work has been done on social vulnerability assessments or the incorporation of community-level information into such assessments.[24] ECLAC, however, has developed and implemented a comprehensive approach to post-disaster impact assessment, which can inform methodologies for economic impact assessment. The Food and Agriculture Organization of the UN has recently supported vulnerability assessments and the development of risk management plans for the agriculture, forestry and fisheries sectors in the Eastern Caribbean.[25] The CDB DMFC has included in its work plan the development of standard vulnerability assessment methodologies. To this end, the CDB will host a workshop on vulnerability assessment techniques, with special attention to social vulnerability, in December 2002.

2. *Who conducts and uses vulnerability assessments?*

As with hazard mapping, specialized vulnerability assessment expertise need not be developed in every country in the region. In support of standard vulnerability assessment methodology, regional centers of assessment expertise should be identified and supported. These centers can exist within specialized faculties of the University of the West Indies, such as Engineering, within sectoral institutions, such as CARILEC, and as part of regional trade associations, such as the Caribbean Hotel Association, the Caribbean Tourism Organization and Caribbean Latin American Action.

Vulnerability assessment is also a useful tool for communities, business and industry. Local groups across the Dominican Republic, for instance, have been trained to identify vulnerable assets and locations within their communities to develop appropriate risk reduction strategies. Through the DMFC, the CDB is planning to pilot the use of local vulnerability assessments as part of the activities of its Basic Needs Trust Fund. It is in the best interest of business and industry sector to ensure that their own assets, and the public infrastructure on which they depend, are resilient to natural hazards. Vulnerability assessments assist in the identification of hazardous areas and vulnerable facilities. Management of these risks to ensure business continuity in the face of natural hazards requires the development of the consistent use of hazard vulnerability and risk information in business decisions.

Box 11: Hazard Risk Management at the Grace Kennedy Group

In Jamaica, the Grace Kennedy Group actively pursues hazard risk management throughout its operations. With the assistance of the Jamaica Office of Disaster Preparedness and Emergency Management, the company has developed and tested a disaster manual and a business continuity plan. Safety and vulnerability audits are conducted regularly on its buildings and facilities. A Group Disaster Preparedness Committee oversees disaster and safety-related activities. Safety reports are included on the primary agenda of the Grace Kennedy board meetings.

Recommendations

- Develop standard vulnerability assessment methodologies for use in the region. The CDB DMFC has begun this work and is well placed to coordinate this effort. Development of the vulnerability assessment methodologies should be coordinated with the hazard mapping standards to be developed

[24] See CDM IR-2.2 #4-6, which support research, evaluation and information collection on the ecological, socioeconomic and socio-cultural impact of disasters.

[25] Developed under the UNFAO project, "Emergency Assistance for the Formulation of National Hurricane Disaster Preparedness and Impact Mitigation Plans for the Agriculture, Forestry and Fisheries Sector."

for the region. Faculties of the University of the West Indies, which can contribute significant expertise to the understanding and assessment of physical, social and economic vulnerability, should be closely involved in this effort, as should ECLAC, due to its experience with economic impact assessment.

- Build regional centers of vulnerability assessment expertise to support the implementation of vulnerability assessment.[26] The University of the West Indies is a logical home for such expertise. Where the requirements of a given sector are sufficiently unique, existing sectoral agencies or trade associations could also develop and provide vulnerability assessment expertise. Multi- and bi-lateral donors and lending institutions should support the strengthening and use of these centers of expertise within their funded activities.
- Develop inventories of critical facilities and resources, by country or regionally by sector. To support the sustainability and currency of these databases, the agencies or organizations responsible for the resources inventoried must be closely involved in information collection, management and use. Model frameworks for such inventories should be developed in parallel to the standard vulnerability assessment methodologies, to ensure that all information necessary for vulnerability assessment is included in the inventories.[27]

E. Ensuring Safer Construction : Building Codes and Standards

1. Enactment is good... Enforcement is crucial

The resilience of new buildings and infrastructure to the effects of natural hazards can be significantly enhanced through the adoption and enforcement of appropriate building standards that are tailored to prevalent local hazards. Significant work has been undertaken throughout the region over the past decade to develop and enact appropriate building codes and standards. A significant initiative was the development of the OECS model building code by the UN Center for Human Settlements and its introduction to most of the OECS countries under the USAID-funded Caribbean Disaster Mitigation Project.[28] In many countries where codes have recently been adopted, the necessary administrative systems, inspection procedures and enforcement mechanisms have yet to be established. In Dominica, for example, a code has been developed and is being used voluntarily, but the legislation to enforce the use of the code has yet to be approved.

Once an appropriate set of building codes and standards have been developed and adopted, decisions to require the use of these codes and standards, combined with the will to enforce those decisions, have the strongest effect on strengthening building practices. In the Turks and Caicos Islands, for instance, awareness and use of the code is high—and numerous copies of the code have been sold—due to a strict adherence to the building code in development review. Building quality on the French side of the island of St. Martin is significantly higher than on the Dutch side, due to the insurance requirement for building plans and construction to be certified by an external consultant.

Significant gaps remain in the implementation and enforcement of building codes and standards. Enforcement of building standards is a national issue and the political will to fully implement building codes and standards needs to be considerably strengthened in almost every country in the region. In Grenada, existing planning legislation does not bind the government and some public buildings do not pass through the planning system to ensure conformity with building standards. In St. Kitts, design standards insufficient to withstand predictable wave and storm surge forces led to the destruction of Port Zante, a significant new cruise ship terminal and pier.

---

[26] CDM IR-1.3: "Other research and data partners in the region are strengthened and rationalized to support CDM."
[27] CDM IR-4.5 #2: "Update and adopt an appropriate economic assessment methodology. Include development of inventory of assets."
[28] A review of the status of building codes in the region is available at http://www.oas.org/pgdm/document/codemtrx.htm.

The national codes developed in the region over the past decade all make reference the Caribbean Uniform Building Code (CUBiC), which is in need of an update. To ensure that the region's building standards are current and appropriate to its needs, the Caribbean Development Bank has committed to support an update to CUBiC and to assist member countries with adopting new building codes and the necessary administrative and enforcement mechanisms. The use of CUBiC as a common reference standard and the OECS Model Building Code as the basis for most new national building codes have contributed significantly to regional harmonization of building codes and standards, and makes possible common training and technical assistance programs within the region.

Box 12: Safer Housing in Vulnerable Communities

A large portion of the housing in the region is constructed outside of the formal development process. Inadequate building materials and standards render much of this housing vulnerable to natural hazards. To address this vulnerability, national development foundations in Antigua and Barbuda, Dominica and St. Lucia have implemented hurricane-resistant home improvement programs at the community level. These programs are designed to strengthen safer building practices in the informal housing sector by conducting safer building training workshops for builders and artisans, and by providing access to loans for home retrofit and upgrade.

Even the most current of standards, however, will be insufficient to effect change if enforcement is ineffectual, as is currently the case in most countries in the region. Building standards must be applied to all development, including public buildings and infrastructure, and particular attention must be paid to specialized infrastructure not covered by standard building codes, such as power generation, large health facilities, ports and airports.[29]

2. Training needs

With the adoption of new building codes throughout the region, there is an urgent need to train building inspectors on the new codes and to institutionalize this training in the technical training institutions in the region. In the past few years, two one-time training courses for building inspectors has been conducted in the Eastern Caribbean.[30] Similar courses should be developed and conducted regularly by institutions that currently offer courses in building technology, such as UTech in Jamaica and the Barbados Community College. Many designers, engineers, builders and construction workers lack proper training in interpreting the new building codes and in applying hazard-resilient building techniques. A multi-hazard building design course was recently developed and conducted by the Council of Caribbean Engineering Organizations. The information developed for this course should be integrated into the engineering curricula in the region. Similar courses should be offered on a regular basis for practicing design professionals. Little control currently exists over the training and qualifications of builders in the region. A certification program for builders, to identify trained and qualified builders should also be considered.

3. Creating incentives

Businesses and industry can significantly increase their own hazard resilience by constructing, purchasing and using facilities that were built according to appropriate building standards. Many private-sector buildings and facilities are reviewed for compliance with building standards, due to mortgage lending requirements, but such reviews often takes place only after construction is complete. To reinforce these building regulations, governments should work with private-sector financial and insurance companies to encourage the development of financial incentives, such as premium reductions or reduced-rate loans, for properly constructed facilities.

---

[29] CDM IR-4.4: "Lifelines and critical infrastructure are protected with mitigation measures."

[30] These courses were organized under the USAID/OAS Caribbean Disaster Mitigation Project (CDMP) and the USAID/OAS Post-Georges Disaster Mitigation (PGDM) in Antigua/Barbuda and St. Kitts/Nevis.

Private-sector companies and organizations can also provide important incentives and support for safer building and adherence to established standards and regulations. Banks and insurance companies can promote better building practices by instituting incentives or requirements for adherence to building codes. Currently, most banks require adherence to building standards to qualify for mortgages. Private building material suppliers can test, make available and instruct consumers on the use of appropriate building materials. In most countries in the Caribbean, appropriate building materials are available, but often without installation instructions. Comprehensive standards for appropriate building materials, however, are generally lacking. Sectoral agencies and organizations should provide their members with specific safer building guidance.

Recommendations

- Identify regional center(s) for strengthening building practices, for harmonizing existing legislation and for developing appropriate enforcement mechanisms.
- Strengthen existing building codes and develop new codes, where necessary, and subject all new development, including government buildings and infrastructure, to the adopted codes and standards. In all countries, building code administration and review mechanisms require significant strengthening. The CDB should give priority to support for updating CUBiC and improving the administration of national building codes.
- Strengthen enforcement of existing building codes and regulations. In all countries, the political will to enforce existing building standards and guidelines needs strengthening. The proposed CDM strategy includes a recommendation for development of model safe building legislation, with minimal political overrides.[31] Regional training programs for building inspectors must be reestablished within regional training institutions and offered on an ongoing basis.
- Develop alternative incentives and enforcement mechanisms for safer building. In the near-term, it is unlikely that government resources will be sufficient to allow for complete building code inspection and enforcement programs. Incentive and enforcement mechanisms developed or implemented by the private sector will be necessary to ensure safe building throughout the region. The most successful such model is the system of external review consultants that is currently in place in the French Antilles. Banks and insurance companies can also assist by imposing requirements and offering incentives for safe building and adherence to building codes.
- Develop mechanisms for ensuring adequate supplies of appropriate building materials, particularly after a disaster. Governments, national bureaus of standards and business and industry should collaborate to develop common standards for building materials for use across the region.

F. Improving physical development planning

1. Land use controls

In addition to the standards to which development is designed, constructed and maintained, location is the other primary determinant of the vulnerability of existing and new development. The most effective way to reduce vulnerability is to avoid development in areas subject to natural hazards. Since this is often not possible, particularly in the hazard-prone Caribbean, such development should be located and designed to minimize the effects of such hazards.

Land use controls are important tools for guiding development to appropriate locations. Primary land use controls include land use plans, physical development standards and assessment tools such as environmental impact assessments (EIAs). Land use and development plans, ideally, are based on a

[31] CDM IR-4.1: "Draft model legislation mandating safe building practices, including adherence to siting and construction codes, with provision to minimize political overrides and regulations for enforcement incentives and sanctions."

careful analysis of existing social, economic, environmental and spatial opportunities and constraints and reflect the development priorities for the plan area. Physical development tools, such as coastal development setback requirements, are best implemented in the context of a broader physical development program, guided by a land use plan, but they can also be implemented separately to address critical issues. Because of the need to repair and rebuild and the availability of funding for these activities, the post-disaster period can provide an important window of opportunity to implement hazard risk management measures. During this period, however, there is often little time to develop new plans or designs to reduce vulnerability. Rehabilitation plans and measures should be developed and approved, with local assistance, in advance of disaster events. This is particularly true of potentially controversial measures, such as relocation plans.

Box 13: Costs and Benefits of Building Resilient Infrastructure: Lessons from Port Zante in St. Kitts & Nevis

Background. In September 1998, Hurricane Georges inflicted particularly severe damage on St. Kitts and Nevis. Besides damage to a large number of houses in low-income communities as well as to an important hospital, a critical cruise ship facility at Port Zante for was damaged and put out of action for four years.

Issue: invest more up-front in a stronger port facility or take a chance on a rare disaster?

How big were the losses? The original cost of construction of Port Zante is estimated at US$22.5M, and the damage from hurricane Georges at 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 further interrupted 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 is estimated at US$26.2M. Assuming a cost of reconstruction of US$4.0M between Georges and Lenny, the government of St. Kitts & Nevis will have spent a total of US$32.9M on construction and reconstruction, net of insurance receipts—US$10.4M more than the original construction cost. In addition, there has been a critical loss of revenue to the national economy over a 4 year period and additional finance charges incurred by government for reconstruction.

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 additional cost, based on experience elsewhere, to withstand higher wave heights is estimated in the 10-15% range. The pier in Plymouth, Montserrat, which has a tropical storm exposure similar to Port Zante, was designed for a 50 year wave, built in 1993, and has not suffered any damage to date.[32]

Lessons

1. 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 hurricane. Based on experience in similar projects throughout the region, the additional investment cost is estimated in the 10 to 15% range, or around $3.0M. This is less than one third of the net additional cost for rebuilding the port, and only slightly more than the estimated additional yearly income [$2 million] a fully operational Port Zante would have generated. Thorough hazard assessments and independent reviews of designs should be required when investing in critical infrastructure.

2. Key economic infrastructure in small islands is often either not insured or under-insured, imposing a significant cost risk entirely on the government. Such risks need to be shared through more effective insurance schemes.

Despite their implications for physical development and infrastructure in the Caribbean, hazards are typically not fully considered in existing land use plans and controls. Often, either the necessary hazard maps and information do not exist or the institutional mechanisms to incorporate hazard information into the planning process are not in place. Where hazard maps are available, they have been considered in current physical planning processes, as is the case in Saint Lucia and with the recently completed draft physical development plan for Antigua and Barbuda. Jamaica's combined planning and environment agency, NEPA, uses hazard maps to impose conditions in planning approvals and is currently strengthening consistency and coordination between the planning mechanism and other sectors.

Existing land use controls throughout the region are generally weak and the political will to implement these development controls is often lacking. Planning and physical development legislation is antiquated

[32] See http://cdcm.eng.uwi.tt/

in most countries in the region. Updates are needed to provide the regulations and enforcement powers necessary to guide appropriate building standards and location decisions. The OECS' Natural Resources Management Unit (OECS/NRMU) has assisted with strengthening and building capacity for physical development planning and environmental impact assessment. With this support, revised planning legislation is under development in many of the OECS member states. New planning acts have been enacted into law in St. Lucia and St. Kitts/Nevis. The new St. Lucia disaster management act includes an innovative provision for hazard inspectors, to assist with enforcement of hazard-related regulations.

2. Environmental and Natural Hazard Impact Assessments

Environmental impact assessments (EIA) are important tools for identifying environmental impacts of development, including those that could increase hazard risk. EIAs are also useful for capturing information on environmental quality and for incorporating the perspectives of other sectors into physical development review and decision making. While EIA mechanisms have been developed in most countries, enabling legislation to require their use is often lacking and many EIAs do not consider hazard issues. In the Dominican Republic, for instance, where project appraisals are required, they focus on primarily on industrial, environmental, economic and political concerns; natural hazards are not generally included. EIA requirements in Jamaica do, however, include hazard considerations.

Natural hazard impact assessments (NHIAs) expand on traditional EIAs by identifying the potential effects of hazards upon proposed developments. NHIAs are a relatively new concept and standard methodologies for conducting them do not currently exist. As part of the DMFC, the CDB is supporting the development of a common methodology for NHIAs for use in project assessments, both internally within the CDB and those conducted by its borrowing member countries.

3. Inter-agency Cooperation in Development Planning

Development planning is an inherently cross-sectoral discipline. In current practice, however, the links between planning and other sectoral agencies, including disaster management, social welfare, environment, agriculture and natural resources, need considerable strengthening. These agencies can provide the technical knowledge required to assess the impacts, both positive and negative, of any proposed new development. In St Lucia, for instance, EIAs are circulated for review and comment by appropriate sectoral agencies, a process which brings important expertise to EIA review and strengthens the knowledge and understanding of environmental impacts among all involved in such reviews. The responsibility for addressing significant regional and global issues, such as biodiversity and climate change, typically falls to agencies and sectors other than development control. Coordination between these agencies and physical development is critical to ensure that land use concerns are appropriately addressed in the larger discussion of these issues and that physical development plans properly incorporate their consideration.

4. Training of local organizations, governments and communities

As the entities most familiar with local conditions and local effects of hazards, local organizations and governments are often best positioned to identify problem areas or developments prior to a disaster event. They should therefore be provided with the knowledge, skills and indicators to monitor risk factors. By ensuring the integrity of their own communities during hazard events, residents will suffer less from hazard effects and be less dependent upon national agencies in times of crisis. In St. Lucia, local disaster committees assist with the identification of structures that are vulnerable to the effects of natural hazards. In Jamaica, parish committees play an important role in development review and approval. In the Dominican Republic, hundreds of communities (although still a minority of communities nationwide) have received training in identifying hazards and vulnerability and in developing appropriate responses.

Information provided by local groups should play a significant role in determining risk management actions throughout the country. Local groups should be able to review and question the standards used in all new developments in their locales. Using existing community structures, mechanisms for incorporating community and individual knowledge into development plans and activities should be fostered.[33] Currently, few such mechanisms exist. In the Dominican Republic, for instance, community groups often critique standards and building practices, but with little effect. Local government in the Eastern Caribbean is generally weak and mechanisms established by national agencies for gathering and responding to local comments are often inadequate. Where active local disaster committees exist, such as in Saint Lucia, they can provide an important conduit for information on hazard conditions and improper development activities to the national government.

Box 14: Promoting Risk Management in Caribbean Hotels

The Caribbean Hotel Association actively promotes hazard risk management among its members. Its *Hurricane Procedures Manual* provides hoteliers with appropriate hurricane preparedness, response and communication strategies and guidance on structural vulnerability and loss reduction measures. The CHA offers a course on Mitigation of Hurricane Damage and Dislocation, based on this manual, which assists participants with development of a hurricane preparedness plan. This course has been conducted in territories throughout the region.

Recommendations

- Strengthen and harmonize physical planning laws and regulations throughout the region.[34] Mechanisms for considering and addressing natural hazards must be included in planning laws, development review procedures and professional training and development for planning professionals.[35]
- Physical planning laws and procedures should include mechanisms for full involvement of local representatives in the development of land use plans and the review of development proposals. The OECS/NRMU should continue its support for the adoption and implementation of new planning laws and administrative mechanisms in the sub-region. Tertiary institutions that offer physical planning programs, including UTech and UWI/St. Augustine, should ensure that natural hazard issues are fully integrated into their curricula.
- Develop common regional methodologies for environmental impact assessments and natural hazard impact assessments. These methodologies should fully address standard development review requirements.[36] The CDB/DMFC has committed itself to supporting the development of a standard NHIA methodology. The OECS/NRMU, given its long support for physical planning and impact assessment, could be an appropriate institution to develop model approaches for fully integrating EIAs and NHIAs into the development planning and review process.

G. Developing risk transfer and financing mechanisms

In addition to direct, immediate damage, catastrophic hazard events can reduce long-term levels of production, consumption and investment in affected countries.[37] The speed with which key infrastructure facilities and commercial assets and homes can be returned to use after damages in a hazard event can significantly affect the long-term impact of the event on a society and economy. When properly managed and applied, risk transfer mechanisms can provide important capital for rapid rehabilitation and

---

[33] CDM, IR-1.2 #5: "Develop/implement program to support or strengthen community level disaster management structure, as needed."
[34] CDM IR-5.1: "Physical planning includes consideration of hazard and vulnerability information."
[35] CDM IR-5.1: "Physical planning includes consideration of hazard and vulnerability information." The specific actions listed under IR-5.1 outline important steps towards the full inclusion of hazard considerations in physical development planning.
[36] CDM IR-5.1 #6: "Link physical planning and approval consideration of hazards and vulnerability to EIA process."
[37] World Bank 2001, *Caribbean Region Catastrophic Insurance.* Report No 22091-LAC.

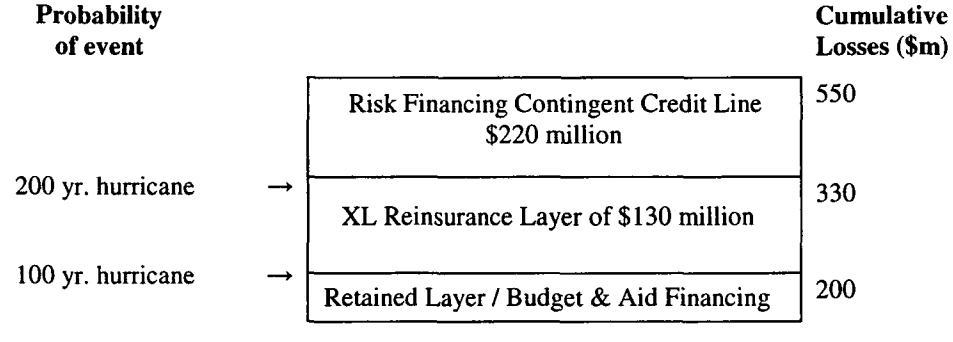
reconstruction. Both governments and business and industry can reduce the financial impact of significant hazard events by setting aside catastrophe funds and by insuring key assets and infrastructure. The role of risk transfer as a tool for overall hazard risk management in the Caribbean can be supported through strengthening the existing insurance market and regulatory system in the region, pooling insured assets to spread risk and providing incentives for investments in hazard risk reduction.

Since risk transfer mechanisms do not reduce overall vulnerability, they should always be implemented in support of, rather than as a replacement for, broad hazard risk reduction initiatives, such as strengthened building practices and appropriate land use planning. Stronger buildings reduce the risk of loss for both the owner and the insurer of the facility. In addition to guiding broad risk management interventions, hazard mapping and vulnerability assessment activities provide important information for pricing of risk transfer instruments, such as insurance coverage.

1. Disaster Contingency Funds

National governments are responsible for much of the major infrastructure and services upon which the economy and population of the country depend. To ensure that damage incurred during hazard events can be quickly repaired, allowing for continuity, governments should allocate contingent disaster funding in the annual budget and insure key assets. Self-insurance allows governments to reduce costs by either foregoing insurance or taking higher insurance deductibles. Currently, only selected government assets in the region are insured —typically government headquarters and national stadiums, as well as some hospitals and airports. In the Eastern Caribbean, a number of countries, including Dominica, St. Kitts and Nevis, Saint Lucia and St. Vincent and the Grenadines, have some funds available at the Central Bank for contingencies. St. Kitts and Nevis has recently moved towards insuring the majority of their assets. In Barbados, the government-owned Insurance Corporation of Barbados is responsible for insuring government assets. In the post-disaster period, governments must also respond to injuries and damages among its citizens. Low-income communities are often the most vulnerable to hazard effects and have the least access to insurance for losses, expanding their reliance on governments during recovery from hazard events. To address these social vulnerabilities, governments must investigate combined vulnerability reduction and insurance programs targeting these vulnerable populations. Contingency funds can also be combined with insurance mechanisms to maximize coverage while reducing cost. In this regard, the utilization of budget funds ("retentions") coupled with (re)insurance and backstop credit facilities will likely generate optimal cost/benefit combinations for government with scarce fiscal resources. An illustrative concept of this is shown below:

Combined Reinsurance and Risk Financing Structure



2. Insurance pooling

One of the primary deterrents to insurance is cost. Many factors contribute to the relatively high and volatile cost of insurance in the Caribbean, including high exposure to hazards, limited financial reserves, high administrative costs, great reliance on reinsurance and the prevalence of under-insurance. In addition to the expanded use of vulnerability reduction measures in the region, insurance costs can be reduced by

regional pooling of insurance coverage. Pooling reduces costs by distributing risk more broadly, both geographically and by hazard exposure. It also generates the benefits of negotiating power particularly for small States, and the ability to negotiate prices based on scale economies. Outside of specific industry groups, such as larger hotel chains, risk pooling is currently not widely practiced in the region. The World Bank has proposed a pilot risk pooling mechanism for the Eastern Caribbean,[38] but delays have arisen in the selection of a sub-regional coordinating agency to serve as the locus for project implementation.

3. Insurance regulation

National governments are empowered to regulate the insurance industry. Insurance regulators should be adequately funded and staffed with trained personnel, to ensure the viability of individual insurance companies. The insurance regulator should have access to all available hazard information to guide the practices of companies operating within the country. Most insurance regulators in the Eastern Caribbean have insufficient funding and trained staff to perform their function and operate without the guidance of adequate hazard information and analyses for valuing assets and loss potential from an insurance perspective. In Jamaica, an outdated insurance act was recently updated and new oversight and funding mechanisms are being developed. The Dominican Republic was found to be an exception, as the insurance regulator is adequately empowered and funded and has a trained staff. Regional initiatives to harmonize and strengthen insurance regulatory agencies and regulations would ensure minimum levels of risk retention and reserve capital and would allow the development of regional supports, such as training programs and a regional reporting mechanism. Establishment of private-sector councils to advise the insurance industry and regulator would provide important guidance in the strengthening of the insurance regulatory system in the Caribbean. A simplified insurance classification system should be developed to guide consumer insurance choice.

4. Creating incentives for public and private insurance

Insurance companies depend upon government programs, such as development and building control, to ensure the resilience of the properties that they cover. To support these important, yet often under-funded government programs, insurance companies can develop incentives, and supportive administrative mechanisms, such as premium reductions and inspection programs. While still uncommon, incentives for proper building are becoming available in an increasing number of countries through private-sector insurance companies.

Business and industry must also prepare for potential damages from natural hazards, through budgeting for disaster contingencies and insuring key and vulnerable assets. Due to fiscal constraints, self-insurance by most business and industry through the reserve of contingency funds is limited. Currently, private facilities covered by commercial mortgages are typically insured, but often only for the balance remaining on the mortgage, rather than the full value of the asset. Within specific industry groups, risk pooling at the regional level can substantially reduce insurance costs, but only the hotel industry has adopted this approach. Direct damage to physical plants is compounded by lost business due to the hazard event. To assist with economic losses subsequent to disasters, businesses should purchase businesses interruption insurance, including coverage for employees.

Some cooperative groups, such as banana and nutmeg cooperatives in the Eastern Caribbean, do provide risk transfer or self-insurance mechanisms for their members. Reserves in such funds, however, are typically insufficient to weather extended difficult periods. Outside of such cooperatives, insurance for crops, many of which are highly vulnerable to hazards, is generally not available in the region.[39]

---

[38] World Bank 2001. *OECS/Barbados Catastrophe Risk Management and Insurance Reform Project: Project Concept Document.*
[39] World Bank 2001, *Caribbean Region Catastrophic Insurance.* Report No 22091-LAC.

Recommendations

- Limit national debt and create disaster contingency funds which might be leveraged with financial or insurance instruments at low cost. Both of these actions allow a more flexible and immediate response to disaster events.
- Governments to insure key facilities. Such initiatives should be informed by comprehensive vulnerability assessments of the facilities and infrastructure to be insured and combined with initiatives to reduce overall vulnerability, with particular focus on low-income and other vulnerable populations. Large Government portfolios may command better pricing given the volume of public property and infrastructure and its associated value.
- Develop and implement insurance risk pools within the region. The proposal developed by the World Bank for such a pool within the Eastern Caribbean should be acted upon and a coordinating agency identified.
- Strengthen insurance legislation, and regulatory oversight and control at both the national and regional levels. This strengthening should include proper staffing and training of existing insurance regulators to ensure the fiscal health of all insurers, use of hazard maps to review levels of catastrophe peril liabilities and development of simplified insurer classifications to guide insurance consumers. The Insurance Association of the Caribbean and its members would be the most appropriate body to advocate for and initiate such changes in the regional insurance system. Consideration should be given tax exempt catastrophe reserves for the private insurance industry, to be kept in trust accounts once accumulated.
- Business and industry groups develop incentives and support mechanisms for overall vulnerability reduction. Regional trade associations for the banking and insurance should develop and promote appropriate measures for use by their members.[40]

IV. The Way Forward: A Program For Action

- If the economic and social impact of future disasters is to be reduced, current practices and policies cannot continue. A new approach to disaster management in the Caribbean is called for, one that incorporates the experience and good practices from hazard risk management and becomes integral to economic planning, investment decision and donor assistance. This approach also needs to build on initiatives already underway, with sustained donor support, in both CDERA and the CDB to improve coordination and integration of risk management activities in the region. Possible priority actions and proposed institutional responsibilities to initiate the implementation of this approach are indicated in the table below.

- Better understanding of the nature, magnitude and potential impact of natural hazard risks is a prerequisite to policy making, as is a clear understanding of the level of risk that various actors should and can assume. To this end, technical capacity in the region needs first to be strengthened by identifying and supporting regional centers of expertise and establishing common methodologies for risk mapping and vulnerability assessments within the region.

- Hazard mapping information and vulnerability assessment tools ought to be further exploited to project contingent liabilities of both the public and the private sectors with regard to potential natural hazard events. This should be coupled with judicious consideration of cost effective risk reduction options and transfer mechanisms which maximize protection while minimizing cost.

- Cooperation between governments, the business community and industry towards hazard risk management needs to be strengthened at both national and regional levels. This should be supported

[40] CDM IR-3.3: "Insurance and finance industries in the region actively support CDM."

by easily available quality information, coupled with implementation of awareness campaigns and training programs. Also, government programs must be complemented by incentives to the private sector to adopt appropriate risk management practices.

- At the national level, economic resilience must be strengthened through limiting debt, creation of disaster contingency funds and transferring of risks. Political will, particularly in the area of enforcement of land use planning and building codes, is a prerequisite for any progress.

- The particular vulnerability of low-income communities needs to be recognized, their potential role in identifying and addressing local hazard risks need to be developed and specific micro-credit, cooperative and self-insurance schemes should be implemented.

V. The Way Forward: A Program for Action

I. Identify and Provide Financial Support for Regional Centers of Expertise

Action	*First Step*	*Possible Lead Agency(ies) for Initial Step*	*Link to CDM strategy*
Regional Center(s) of Expertise for Hazard Identification and Vulnerability Assessment. Identify and support regional centers of expertise for hazard mapping, vulnerability assessment and natural hazard impact assessment.	Conduct baseline institutional assessment and review of existing materials. Organize regional consultation to identify and designate appropriate center(s).	CDB DMFC, CDERA, UWI	IR 1.3 IR 2.2
• **Common Methodologies.** Develop common regional methodologies for hazard mapping, vulnerability assessment and natural hazard impact assessment.	Identify and review existing methodologies, draft model approach for testing.	CDB DMFC, CDERA, UWI, OAS	IR 1.3
Regional Center(s) of Expertise for Risk Reduction Measures. Identify regional center to strengthen building practices, to harmonize existing legislation (including building codes, physical planning and disaster management) and to develop appropriate enforcement mechanisms.	Organize baseline review and regional consultation to identify and designate appropriate center(s).	CARICOM Secretariat, UWI Engineering	IR 1.3 IR 2.2
• **Enhanced Implementation of Risk Reduction Measures.** Strengthen implementation and enforcement capacity for building codes and physical development standards within the region.	Conduct assessment of the weaknesses of the present system and the potential links to private sector interests.	CDB DMFC, OECS/NRMU, IAC	IR 4.1 #3 IR 5.1 #3
• **Current Building Standards.** Update the Caribbean Uniform Building Code and include provisions to address adaptation to climate change.	Review and support existing proposal to update CUBiC.	CDB DMFC, CARICOM Secretariat	
• **Coordinated Initiatives.** Develop a mechanism for integrating public and private sector risk management information and experiences.	Identify measures to stimulate business and industry to undertake risk management measures in coordination with Governments. Identify government incentives that could motivate business and industry to minimize risks.	CTO, CHA/CAST, IAC, CLAA, PADF	

II. Mainstream Hazard Risk Management

Action	*First Step*	*Possible Lead Agency(ies) for Initial Step*	*Link to CDM strategy*
Information Clearinghouses. Identify national and regional clearinghouses for hazard information; develop open sharing and distribution mechanisms for hazard information, for governments, the private sector and the public in general.	Organize baseline review of potential institutions. Develop model data sharing and distribution guidelines.	CDERA, UWI, CDB DMFC	IR 2.3
Development and Economic Growth. Integrate hazard risk management into development decision-making through planning and budgeting, with emphasis on the impacts of decisions and resource allocations on critical facilities and in low-income communities.	Review good practices and develop methods for integrating risk appraisal into the public-sector budget process. Develop risk management training components for government and private sector development planning courses.	CDB DMFC, ECLAC	IR 4.5 #3
Legal Framework. Adopt national building codes, physical planning acts and corresponding administrative and enforcement mechanisms.	Finalize adoption of building codes, where pending. Develop model for code administration. Develop, adopt and implement updated physical planning legislation and frameworks.	National Cabinets	IR 3.2 IR 4.1
Incentives for Risk Management. Establish public and private sector incentives for proper risk management, such as insurance premium reductions and tax incentives.	Identify and publicize successful public and private sector incentives for appropriate risk management practices. Define training needs.	ECCB, Ministries of Finance, Chambers of Commerce, IAC, Banking Sector	IR 5.2

III. Expand Use of Risk Transfer Measures

Action	*First Step*	*Possible Lead Agency(ies) for Initial Step*	*Link to CDM strategy*
Public Sector Exposure. Understand and define limits of public sector responsibility for hazard risks.	Review levels of existing risk, including key infrastructure, and determine the level of risk that can be assumed.	Ministries of Finance, ECCB	
• **Vulnerable Communities.** Address the special vulnerabilities of low-income communities.	Develop micro-credit, cooperative and self-insurance schemes.	ECCB, Ministries of Finance, Community NGOs, National Development Foundations	
Sharing Risk. Develop risk pooling mechanisms at the sub-regional and regional levels.	Implement the Eastern Caribbean Risk Pooling proposal.	ECCB, CDB	
Insurance Industry. Strengthen oversight of the insurance industry and rationalize market.	Improve insurance supervision at the national and regional levels and ensure adequate reserves for retained risk.	ECCB, IAC	[IR 3.3]

IV. Donors and Regional Lending Institutions to Promote Risk Management

Action	*First Step*	*Possible Lead Agency(ies) for Initial Step*	*Link to CDM strategy*
Donor Support. Strengthen commitment to risk management considerations in all funded activities.	Incorporate hazard and vulnerability assessment in project design and appraisal, using consistent methodologies and standards during project preparation and execution	CDB, Bi-lateral Donors, UNDP, IDB, World Bank	IR 3.1
Donor Coordination. Coordinate risk management activities in the region with other donors and lending institutions using the CDM framework.	Establish mechanism for coordination of donor-funded risk management initiatives, through existing donor groups or through a new mechanism.	Eastern Caribbean Donor Group, CDB, World Bank	IR 3.1

VI. Bibliography

Cambers, Gillian, 1996. *Hurricane impact on beaches in the eastern Caribbean islands 1989-1995.* COSALC Report.

Caribbean Disaster Emergency Response Agency, 2001. *Caribbean Disaster Management in the Caribbean: Baseline Study.*

_____, 2001a. *A Strategy and Results Framework for Comprehensive Disaster Management in the Caribbean.*

Government of the Commonwealth of Dominica, 1995. *Tropical Storm and Hurricane Damage and Rehabilitation (1995)*

Inter-American Development Bank, 2002. *Natural Disasters in Latin America and the Caribbean: An Overview of Risk.*

Lavell, Allan, *Decision Making and Risk Management.* Paper presented at the Conference on "Furthering Cooperation in Science and Technology for Caribbean Development", Port of Spain, Trinidad, 23–25 September 1998.

Université Catholique de Louvain, Brussels Belgium, 2002. *OFDA/CRED International Disaster Database (EM-DAT)* [http://www.cred.be/emdat/]

US Agency for International Development (USAID) 1999. *Hurricane Georges Reconstruction and Recovery in the Eastern Caribbean, Special Objective Document.*

USAID/Dominican Republic 1999. *Hurricane Georges Recovery and Reconstruction, Special Objective Document.*

USAID/Jamaica, 2000, *Hurricane Lenny Recovery in the Eastern Caribbean.*

USAID/Haiti 1999. *USAID/Haiti Operation Bounce Back Post-Hurricane Georges Recovery Program*

Vermeiren, Jan, 1993. "Disaster Risk Reduction as a Development Strategy." Paper presented at the 1993 US National Hurricane Conference. [http://www.oas.org/cdmp/document/lossredn.htm]

_____, 2001. "Increasing the Resilience to Hurricanes as a Strategy to Reduce Climate Change Risk." Presented at the US Southern Command Conference on Regional Cooperation in Disaster Prevention and Response in Central America", San Jose Costa Rica, March 2001.

World Bank 2001, *Caribbean Region Catastrophic Insurance.* Report No 22091-LAC

_____, 2001a. *OECS/Barbados Catastrophe Risk Management and Insurance Reform Project: Project Concept Document.*